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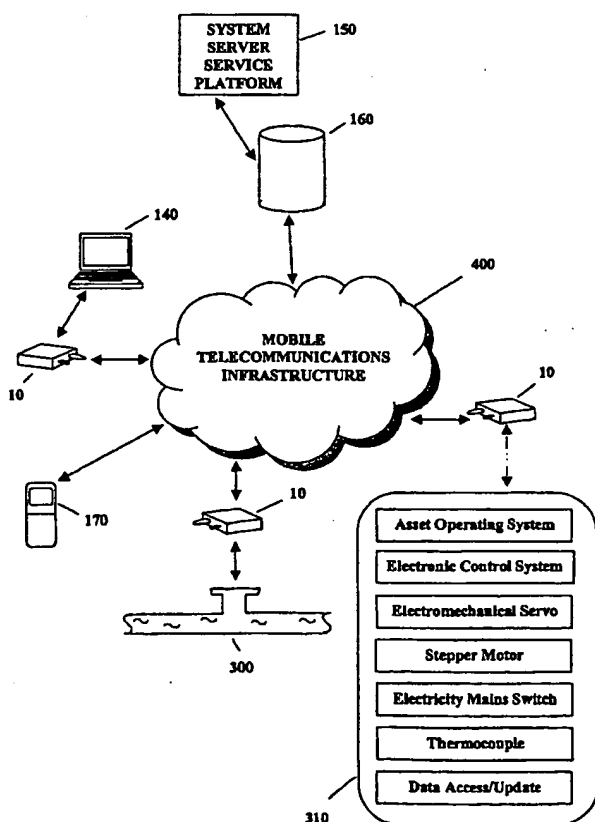
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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR REMOTE ASSET MANAGEMENT



(57) Abstract: A system and method for remote asset management is described which can provide the basis for a diverse product group including an improved remote location monitoring system, a means for communicating with and for monitoring the status and or location of a plurality of diverse assets, as well as the means for communicating with said assets for the purpose of modifying the operational status of one or more of said assets according to one or more stored data parameters such as location, use, battery power, and such like. The remote asset management system comprises a wireless module, which is associated with at least one of the plurality of assets and which is interfaced with the operating system of said asset and or with an electromechanical control means, which may control one or more features of the operation of said assets. A supporting network-based, or internet-based service platform controls and manages the status of each of the plurality of assets, either automatically, or in response to received messages from fixed or wireless communication devices, and which is capable of selectively communicating data to said assets for changing the operational status of said assets according to pre-programmed conditions.

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## SYSTEM AND METHOD FOR MONITORING AND CONTROL OF WIRELESS MODULES LINKED TO ASSETS

**DESCRIPTION**

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**BACKGROUND OF THE INVENTION**

The invention relates to a system and method for remote asset management. More particularly, it relates to a system and method for  
10 remotely managing a plurality of assets, which may be fixed or movable, wherein each comprises a wireless module interfaced with the operating system or control means of said asset and is capable of exchanging asset control data with operational data stored remotely on a dedicated server platform. The said system and method for remote asset management can  
15 provide an improved means for locating, monitoring, and controlling remotely the use of fixed and or movable assets as well as providing the basis for a network-based service platform for providing a range of diverse corporate and consumer services.

20 The invention relates to and significantly improves upon a previously filed patent application claiming Finnish priority of 23<sup>rd</sup> May 2000 entitled Programmable Communicator published as international patent application WO 01/91428 A2.

25 In this previously filed application, is taught the invention of an improved wireless telecommunications platform for remote monitoring purposes which can be programmed remotely by a mobile phone or any type of Personal Data Assistant, either at close range using Blue Tooth, or infra red light, or via a mobile telecommunications network connection.

30

The current invention builds upon the teaching of this earlier application and extends the concept significantly such that it has more general and suitable application for remote asset management and control of the asset by making use of a programmable wireless module, which is linked  
35 to an asset interface module associated with the asset via a programmable port module.

Today, the mobile telecommunications industry is making a transition towards high bandwidth high capacity 3<sup>rd</sup> Generation wireless networks. The associated costs of the 3<sup>rd</sup> Generation wireless network infrastructure and the lack of market drivers are challenging the growth of the mobile industry. Clearly, a diverse range of mobile services is required which can offer a high growth of subscription contracts and which can also run efficiently and effectively on today's 2<sup>nd</sup> Generation telecommunications infrastructure. The system and method according to the present invention is directed towards this requirement area.

Generally, few interactive systems are available which make the most efficient use of the limited bandwidth of the 2<sup>nd</sup> Generation telecommunications infrastructure. In particular, the remote monitoring of assets and facilities is not optimised to make use of the mobile telecommunications network infrastructure in the most efficient and cost-effective way. Today, a diverse range of electronic tags is available for determining the location of vehicles and such like, while other systems are available for providing operational status data of remote devices. In the case of facilities security, private individuals either choose to invest in improved door and window locks or pay high subscription rates for outsourced security.

In the context of mobile telecommunications there exists a need for a more efficient solution in the area of remote asset management. To improve upon prior art systems it would be beneficial if each asset would comprise the capability to enable a remote server to determine the operational status of the said asset and change its operational status according to preset conditions, thereby affording the provision of a range of diverse services for a wide range of asset management applications.

In the area of remote facilities management, it would be beneficial if fire and intruder alarm systems were fully integrated and could communicate automatically via a remote system server to alert the appropriate emergency services. Moreover, in places where there is limited fixed telecommunications infrastructure, such a system would benefit from a wireless capability.

In the area of laptop computers, which contain valuable or strategic data, it would be beneficial if a remote asset management solution existed which could determine the location of the computer, and or change the operational condition of the computer and its related power supply and or  
5 render the computer unusable from a remote location by making use of data messages transmitted to the computer from a remote server. Such a solution would both help to locate the computer remotely and prevent unauthorised access of stored data. Also, and in general, such a solution would enable a company to trace the whereabouts of its computer workstation inventory  
10 automatically by sending requests for each to return its current GPS coordinate.

In the same area of application, laptop users sometimes experience difficulty in accessing their computer when it is locked down due to an  
15 access password being forgotten, or when the process of changing the password is interrupted after the old password expires. Such a situation can be quite stressful if a professional user is travelling on behalf of her employer and must make a laptop presentation to a client. Today, this access denial situation is usually remedied by contacting the company help desk,  
20 authenticating oneself, and requesting the default hard drive password. Often, help desk staff are unavailable or they require details to be E-mailed, which is impossible when access is denied. Furthermore, remote authentication and transfer of complicated default drive passwords is very challenging. A system and method, which makes possible the remote  
25 authentication of the laptop user and subsequent transfer of the default password to the laptop by sending data messages via a remote server, would be very beneficial.

In the area of consumer devices such as video recorders and other  
30 household equipment including heating systems and the like, it would be beneficial if equipment could be programmed remotely. Such a system would enable a consumer to send simple commands via a remote server to a solid-state video recorder to record a favourite program or to switch on a sauna heater or central heating system remotely.

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In an additional application area there exists the need for a system and method to enable authorised personnel to interact with systems and change their operational status by use of, for example, a mobile phone or similar PDA device. Road safety, for example, would be improved if it were  
5 possible for a highway patrol officer to activate and or change highway traffic speed indicators from his vehicle or from his handheld wireless communicator in the case of a change in driving conditions such as due to an accident or change in weather.

10 In an additional application area, there exists the need to monitor the operational status of an asset for servicing purposes. A vehicle, for example, would benefit from a system, which could link the vehicle to a vehicle-servicing centre to enable remote analysis of the engine performance and thereby assist vehicle service scheduling. Furthermore, the same system  
15 would enable remote management of the engine such that changes to the engine operation parameters could be uploaded as well as providing the means to disable some features of the vehicle to help prevent theft. Clearly, a remote lock-down feature combined with a position determination capability would greatly reduce vehicle theft and improve recovery of a  
20 stolen vehicle.

In an associated vehicle application area there exists the need for a system and method to update the stored data on satellite navigation vehicle guidance systems. Such systems when deployed do not have the facility for  
25 the road data to be updated as road systems change. A system and method, which would make possible the updating of the data in an efficient way, would greatly improve the usability of such systems

In the area of mobile phones and other battery operated equipment,  
30 such as laptops or radio transponder identification tags, it would be beneficial if the devices could be programmed remotely to power down for certain periods of time and to power up for certain pre-programmed intervals. Such a programmable power duty cycle would greatly extend the time between charges of the associated battery supply and when combined  
35 with an integrated self-positioning Satellite Navigation Global Positioning System capability, would enable transponder tracking on a need-to-know basis. When tagged inventory is in warehouse facilities there is no need to monitor regularly the location of the assets. Should the inventory be mislaid, such a capability would greatly assist in locating the asset in a way, which  
40 makes the most efficient use of the associated battery supply.

It would be further beneficial if the device had the additional capability to report back the battery charge level of the battery supply to a remote server to indicate when the device would need recharging. The same system would also afford the capability to auto-power up and transmit other data  
5 according to a range of preset alarm conditions.

In a further area of application, consumers would benefit from a system, which gathered data according to the use of a particular asset and forwarded this data to a remote server for the purpose of optimising the  
10 asset and for designing an appropriate range of services to support the said use of the asset. For example, any communication device which comprised a range of options such as pull down menus for internet or dedicated service access might be improved if the range of options were prioritised automatically according to the way the user preferred to use the device or in  
15 the order of access of mostly used features.

In a further area of application, consumers would benefit from an automatic parking meter having a designated identification, which could receive messages via a remote server from a vehicle owner's mobile phone  
20 and program the parking meter for a period of time. In such a way parking meters could be charged against the mobile phone owner's subscription and the vehicle owner would not need to leave the vehicle and put money into the meter.

In a further area of application, consumers would benefit from a system, which would enable utility meters such as gas, water and electricity meters to be read remotely. If a device were integrated with the readout of the meter such that usage data could be communicated wirelessly, such a system would save the time and effort involved in reading the meter  
25 manually.  
30

In an additional application area, in an instance where a security guard is alerted and wishes to secure a monitored area, it would be beneficial if a mobile phone message could be received by a remote server and cause data  
35 instructions to be communicated to one or more wireless control modules which might lock doors remotely or disable the functionality of certain devices.

In an additional application area, hikers and mountaineers or skiers in difficulty would benefit from a smart clothes user-programmable communications tag which comprised the means to attach itself to their clothing, which is pre-programmed to be linked with a fixed or mobile telephone and need only have its protruding button pressed to make communication with a central alarm point. Moreover, in an instance where an individual is lost or injured and less able to communicate effectively, a system solution is needed which automatically translates a GPS positional coordinate into a meaningful text message or voice message giving clear details of who the person is and where the person is calling from.

In the application areas outlined above, such as for attaching a wireless communications module to an article of clothing, or to a device to be monitored, an improved rugged design is required which both protects the cellphone engine and battery and which looks stylish. For example, in the application area of youth security, children are often reluctant to wear the device unless its shape and form has a positive association with an icon of fashion or an extreme sport such as mountaineering. The shape and form of the wireless module is designed to address this image aspect directly.

In an additional application area such as for freight tracking and asset location, an improved design for an electronic tag is required which is fully integrated with the packaging material surrounding the asset. In the particular application of passenger luggage, suitcases and briefcases should comprise the means to enable remote asset tracking and location determination as well as remote control of access to the luggage wherein the means is fully integrated with the structure and locking means of the luggage.

In a further area of application, consumers would benefit from a system, which would improve the security involved with cash withdrawal from a bank Automatic Teller Machine using a bankcard. An auxiliary system and method, which enabled a specific ATM to permit a bank customer to use their bankcard to access and withdraw funds for a predetermined time interval, would reduce crime. If the system required such a message before cash could be withdrawn, stealing ATM bank cards would be less attractive.



Today, the mobile telecommunications infrastructure is designed and utilised almost entirely as a wireless communications channel for voice communication and for sending data messages wherein the mobile phone is considered as an end point of the communication. The system and method  
5 for remote asset management of the current invention significantly extends the capability of the wireless infrastructure through the management of wireless modules associated with remotely located assets such that the said wireless modules are no longer communication end points within  
10 themselves but serve as functional gateways for controlling associated assets. Correspondingly, the system and method according to the current invention provides a versatile means for building and operating a diverse and comprehensive set of consumer and business services.

Further to these limitations of existing technologies, and so far as is  
15 known, no wireless asset management system and method is presently available which is directed towards the specific needs of this problem area as outlined.

## OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved remote asset management system, which comprises the means to communicate data from a fixed or mobile communications device either directly or via a remote server to one of a plurality of wireless modules, each associated with at least one remotely located asset to be managed, such that the communicated data enables the operational characteristics of the said asset to be monitored and or modified according to pre-programmed conditions.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a dedicated network server or Internet-based server, which is programmed with the operational details of a plurality of assets to be managed remotely and which manages the communication messages sent to and received from the wireless modules each associated with at least one of said assets.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a plurality of wireless modules such that each wireless module is interfaced with an operational feature of an asset to be monitored such as the software operating system of the said asset such that data messages sent to the wireless module may thereby effect some change in the use or performance of said asset.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a plurality of wireless modules such that each wireless module is interfaced with an operational feature of an asset to be monitored such as the electronic control means of the said asset such that data messages sent to the wireless module may thereby effect some mechanical change in the use or performance of said asset.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a plurality of wireless modules such that each wireless module is interfaced with an operational feature of an asset to be monitored such that the said module may comprise  
5 or be interfaced with an electromechanical servo means which may be controlled directly through data messages sent to the wireless module and thereby effect some mechanical change in the use or performance of said asset.

10 It is a further object of the present invention to provide an improved remote asset management system, which comprises a plurality of wireless modules such that each wireless module is interfaced with an operational feature of an asset to be monitored such that the said module may comprise  
15 or be interfaced with a stepper motor means which may be controlled directly through data messages sent to the wireless module and thereby effect some mechanical change in the use or performance of said asset.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a plurality of wireless  
20 modules such that each wireless module is interfaced with an operational feature of an asset to be monitored such that the said module may comprise, or may be interfaced with a thermocouple means which may pass voltage values to the wireless module corresponding to temperatures measured by said thermocouple.

25  
It is a further object of the present invention to provide an improved remote asset management system having direct application to the remote reading of gas, water and electricity utility meters, which comprises a plurality of wireless modules wherein each module is associated with at  
30 least one utility meter such that each wireless module may comprise, or may be interfaced with an inductive coil reading system to enable encoded output utility meters and pulse output utility meters to be read remotely by the utility service company.

Alternatively the module may be directly interfaced with the flow meter itself such that where a changing jet of water flow causes an electromotive force to be generated in a flow device such that this force disrupts a powerful magnetic field which is passively monitored by a number of electrodes which send a signal to a processing circuit, the rate of flow generated by the frequency of oscillation is totalised and sent directly to the wireless module as a totalised flow measurement either periodically or in response to receiving a request from the wireless module.

It is a further object of the present invention to provide an improved remote asset management system having direct application to remote environmental sensing systems, which comprises a plurality of wireless modules wherein each module comprises or is associated with the means to sense one or more of the following environmental data types such as acidity level, alkalinity level, concentration of dissolved oxygen, carbon monoxide level, contaminant concentration, level of radioactivity, ultrasound level, humidity level, air pressure level, levels of rivers, and wind speed, and wherein each module may further comprise a solar cell to recharge its own power supply.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a remote server which is designed to receive and process incoming data messages from one or more fixed or mobile communications devices wherein said messages relate to specific remote asset management applications or personal security applications such that the said server is programmed to communicate specific application data and or voicemail messages to one or more wireless modules and or fixed or mobile subscriber numbers and or IP addresses or Email addresses in response to receiving each of said data messages.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a remote server that is pre-programmed to receive and process subscriber number information and GPS coordinate information such that it may cause a data message and or a voicemail message to be sent to a specific fixed or mobile subscriber number and or IP address or Email address in response to the receipt of said GPS coordinate information.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a remote server that is pre-programmed to receive and process subscriber number information and or IP address identification and GPS coordinate information from each of a plurality of wireless modules wherein following processing of the received data from a specific wireless module, the server may determine that a data message is to be sent to the specific module which causes a change in the operational status of the wireless module and or associated asset.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a remote server that is pre-programmed to store operational data for one or more types of asset including one or more data types such as asset type, asset model number, asset operating system type, asset power supply type, back-up battery supply, power supply duty cycle parameters, critical parameters for disabling specific functionality of the asset, location data of the asset as a function of time and stored at specified intervals for a specified duration, asset performance monitoring parameters, service history of the asset, location history of the asset, performance optimisation parameters, and security lock-down features. The said server may also receive data periodically, and or it may request data according to predetermined conditions, and or it may be sent data by the wireless module in response to a change in status of the associated asset such as an alarm condition or in response to a status interrogation request sent to the wireless module from any fixed or mobile device.

It is a further object of the present invention to provide an improved remote asset management system, which makes possible the creation of a diverse range of new mobile services which can offer a high growth of subscription contracts and which can run efficiently and effectively on existing telecommunications infrastructure without requiring any changes to the said infrastructure.

It is a further object of the present invention to provide an improved remote asset management system, which is capable of determining the location of vehicles as well as offering the means to monitor and or change the operational status of one or more systems operating on the vehicle.

It is a further object of the present invention to provide an improved remote asset management system, which comprises a plurality of wireless modules wherein each may comprise a GPS module and wherein each is capable of periodically determining a GPS position fix and storing this data  
5 according to a programmable period such that a remote server can request one or more of the stored data and the times when the data were stored.

It is a further object of the present invention to provide an improved remote asset management system for vehicle service applications, which is  
10 capable of remotely monitoring the performance of the vehicle engine and transmitting performance enhancement data to the vehicle to modify the performance of the engine.

It is a further object of the present invention to provide an improved  
15 remote asset management system for vehicle service applications, which comprises the capability for remote fault diagnosis and vehicle service scheduling such that in response to remote analysis of engine performance data, the vehicle service centre may communicate directly with the vehicle display panel and communicate when the vehicle should next come for  
20 servicing.

It is a further object of the present invention to provide an improved remote asset management system for the application of satellite navigation vehicle guidance systems, wherein the system and method provides the  
25 means to complement vehicle GPS systems by making possible the receipt and storage of up-to-date route data by the said vehicle system. Over time, the stored GPS data becomes outdated as changes are made to the road network. The remote asset management system according to the invention can organise and transmit navigational map data to complement and or  
30 modify the GPS data stored in the vehicle system. Such updates may be made using encoded messages, such as SMS, and transmitted over the mobile phone infrastructure to the wireless module associated with the in-vehicle navigation system when the network is least congested such as during the night.

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It is a further object of the present invention to provide an improved remote asset management system for facilities management, which comprises the means to communicate data to a remotely located server automatically, and or periodically, and or in response to a change in  
5 environmental conditions monitored by a dedicated sensor means associated with the asset such as change in temperature and or the movement of air and or a change in sound level and or a change in the monitored chemical composition of the environment and or change in light intensity and or change in humidity.

10

It is a further object of the present invention to provide an improved remote asset management system for facilities management, which affords the capability for a new and improved wireless fire alarm.

15

It is a further object of the present invention to provide an improved remote asset management system for facilities management, which comprises the means for remotely monitoring and controlling the functionality of an air conditioning system.

20

It is a further object of the present invention to provide an improved remote asset management system for facilities management, which comprises the means for remotely controlling the power to a mains powered device such that data messages received by the wireless module may cause the mains power to the said device be switched on or off.

25

It is a further object of the present invention to provide an improved remote asset management system for facilities management, which comprises the means for remotely monitoring access to a building or enclosed area and communicating the presence and or movement of any  
30 persons within the monitored facilities to a remotely located server either independently or in response to status monitoring requests. Furthermore, according to changes in the data values generated by the said facilities management system, the server may consequently generate one or more alarm conditions and communicate data messages to security personnel and  
35 or security control centres and or systems controlling doors and barriers which allow access to the said facilities.

It is a further object of the present invention to provide an improved remote asset management system for facilities management, which comprises the means for remotely monitoring the status and or changes in the positions of doors and windows and communicating said changes to a remotely located server either independently or in response to status monitoring requests.

It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate with a wireless module associated with a computer for the purpose of remotely monitoring the use of the computer and or for sending data to the computer for the purpose of changing the performance of the computer.

It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate remotely with a laptop computer wherein said computer comprises a wireless module comprising a GPS chipset such that the said module may be remotely interrogated to determine its current geographical location and or one or more previously stored geographical coordinates.

It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate remotely with a wireless module associated with a computer, either independently and or periodically, or in direct response to a change in status of one or more operational parameters of the said computer such that the wireless module further comprises the means to render inoperable certain or all functionality of the said computer thereby preventing access to any stored data.

It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate remotely with a wireless module associated with a fixed or portable computer such that a default access password can be transferred to the said computer, either directly or via a remote server, to enable an authorised and authenticated user to gain access to the data on the computer when the user has forgotten the access password or when the password does not work.



Furthermore, the transfer of a first access password to the said wireless module may activate a software module which both establishes a secure communication channel between the laptop and the company helpdesk server and provides sufficient access to the computer to enable the user to  
5 authenticate herself by returning confidential identification data to the authentication server at the company premises such that the server may authenticate the user and authorise complete access to the computer by sending a second access password to the wireless module.

10 It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate remotely with a wireless module associated with a computer, either independently and or periodically, or in direct response to a change in status of one or more operational parameters of the said computer such that  
15 the wireless module further comprises the means integrated with the motherboard of the computer to enable remote access to the critical control parameters of the computer's operating system such as for example to enable the BIOS parameters to be changed remotely.

20 It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate remotely with a wireless module associated with a computer, such that the communication channel between a remote server and the said wireless module is encoded using a pair of keys wherein each is generated  
25 from data stored at either end of the communication link.

It is a further object of the present invention to provide an improved remote asset management system, which comprises the means to communicate remotely with a wireless module wherein said module  
30 comprises a rechargeable power supply and or an associated solar cell for recharging the power and or it may comprise an additional NICAD cell or equivalent battery of limited power, such that the rechargeable power supply comprises a timing means and a control means to enable remote management of the power duty cycle of the said module. In particular, the  
35 wireless module may receive data messages, which instruct the module to power down to a very low level, thereby conserving power, such that the power level is sufficient to maintain timing and control functionality which enable the module to power up at predetermined intervals to enable exchange of data with the remote server.

40

In this way the interval between recharging is greatly extended and the wireless modules only power up according to a predetermined duty cycle.

5 It is a further object of the present invention to provide an improved system and method for remote asset management, which is suitable for any type of wireless device in general, such as a mobile phone, wherein each said device comprises a rechargeable battery and a duty cycle power management capability such that the wireless device can be remotely  
10 programmed via a server or via a computer connected to the Internet or directly from another wireless terminal or directly programmed manually to cause the said device to power down for predetermined intervals and thereby extend the interval between battery recharging. All manner of remote programming methods may be employed such as SMS, GPRS, data call and GSM EDGE as well as WLAN, TCP IP, Infra Red light and Blue  
15 Tooth radio communication. In particular, each wireless device may be programmed to power down automatically when communication is not suitable such as during regular sleeping hours and to power up when persons are available for communication such as during working hours, in between lectures and or during lunch intervals.

20 It is a further object of the present invention to provide an improved remote asset management system, which is suitable for the remote programming of consumer devices such as solid state video recorders and other household equipment including heating systems and the like wherein  
25 the remote server may monitor the scheduling of preferred television broadcasts according to stored user preferences and forward messages of upcoming programmes to the user and organise the programming of a home video recorder in response to receiving messages back from the user. Similarly other household equipment such as a sauna heater or heating  
30 system may be controlled remotely.

It is a further object of the present invention to provide an improved remote asset management system, which is suitable to enable authorised personnel to interact with systems and change their operational status by use  
35 of, for example, a mobile phone or similar PDA device such as for the activation or change of highway traffic speed indicators, wherein the wireless module receives data from authorised personnel or systems to change the display of the speed indicator to suit changing driving conditions due to an accident or change in weather.

40

It is a further object of the present invention to provide an improved remote asset management system, which is suitable for radio transponder identification tags wherein the tags are programmed remotely to power  
5 down for certain periods of time and to power up for certain pre-programmed intervals. The programmable power duty cycle extends the time between charges of the associated battery supply and when combined with an integrated self-positioning Satellite Navigation Global Positioning  
10 System capability, makes possible transponder tracking on a need-to-know basis. The transponder tag also has the capability to report back the battery charge level of the battery supply to a remote server to indicate when the device would need recharging. The same system also affords the capability to auto-power up and transmit other data according to a range of preset  
15 alarm conditions as determined by sensors associated with the wireless module.

It is a further object of the present invention to provide an improved remote asset management system, which has application to freight tracking  
20 and asset location and personal luggage security wherein the wireless module is fully integrated with the packaging material surrounding the asset and or the structure of the said luggage and or the associated locking means of a suitcase or briefcase or the like.

It is a further object of the present invention to provide an improved remote asset management system, which gathers data according to the use of a particular asset and forwards this data to a remote server for the purpose of optimising the asset and for designing an appropriate range of services to support the said use of the asset wherein the wireless module may comprise  
30 a display having a range of options such as pull down menus for internet or dedicated service access and wherein these might be improved if the range of options were prioritised automatically according to the way the user preferred to use the device or in the order of access of mostly used features.

It is a further object of the present invention to provide an improved remote asset management system having direct application to automatic parking meters having a designated identification, wherein each parking meter comprises a wireless module according to the present invention such that it is able to receive messages via a remote server from a vehicle owner's mobile phone and program the parking meter to indicate paid parking for a specified period of time.

It is a further object of the present invention to provide an improved remote asset management system having direct application to hikers and mountaineers or skiers in difficulty wherein each such person has a smart clothes user-programmable communications tag which comprises the means to attach itself to their clothing, which is pre-programmed to be linked with a fixed or mobile telephone wherein it comprises a single call button for communication with a central alarm point and has the capability to establish voice communication and or transfer data messages comprising a current GPS coordinate and or a voicemail message to a destination subscriber number of a fixed or mobile phone or to an IP address.

Other objects and advantages of this invention will become apparent from the description to follow when read in conjunction with the accompanying drawings.

### BRIEF SUMMARY OF THE INVENTION

Certain of the foregoing and related objects are readily attained according to the present invention by the provision of a novel remote asset management system and method, which serves to address the diverse requirements of industrial asset and consumer asset management and for the purposes of remote performance control and for the generation of alarm messages when the operational ranges of one or more operational parameters of the associated one or more assets exceed predetermined thresholds.

The remote asset management system preferably comprises a wireless module wherein each is associated with at least one remotely located asset and wherein each module comprises a telecommunications means to enable it to communicate using any wireless telecommunications network such as GSM, GPRS, CDMA, WCDMA, CDMA2000, WLAN, Blue Tooth and other technologies such as Infra Red and Home RF and the like.

Where appropriate, in alternative embodiments, the wireless module may additionally comprise a GPS means to enable remote tracking of the module. The wireless module further comprises a port module through which the device is able to communicate with an associated asset. In addition, the wireless module comprises a memory means to support a data processing application to communicate with the associated asset through the port module. The module either draws its power from an associated power source such as a solar cell or the power supply of the associated asset, or it comprises its own rechargeable battery and programmable power duty cycle.

The wireless module, either directly from another wireless device or from a remote system server, receives messages via the telecommunications network infrastructure for the purposes of interrogating the status of the wireless module and or the status of one or more of the associated assets. Messages are authenticated according to access rights and each may comprise data to be sent through the port module to change the operational parameters of the associated asset.

The remote asset management system and method has direct and effective application to diverse asset management scenarios from warehouse inventory management to remote programming applications such as for programming a solid state video recorder remotely. Moveable assets such as vehicles, bicycles and freight, as well as laptops, are conveniently and effectively tracked through associating a wireless module with each asset and providing a network-based system server service-platform, which is linked to the telecommunications network infrastructure and which has the means to store and run a number of remote asset management software applications to provide diverse asset tracking and remote control solutions. Additionally, the remote asset management solution has direct and efficacious application for the remote reading of gas and water utility meters.

The associated network-based service-platform is programmed with dedicated software application modules, each capable of managing one or more separate remote asset tracking applications. Messages can be sent to and from the service-platform between the wireless modules according to the current invention and or between other wireless devices such as mobile phones and wireless PDA devices.

Each server-based software application module is tailored to map a set of asset operational parameters to ranges of acceptable operation and the application module is further capable of generating alarm messages when data received from a particular asset indicates that it is operating outside  
5 acceptable operating ranges.

The service platform has the capability to generate data messages to be sent to the wireless module associated with a particular asset for the purposes of causing some desired change in the said asset.

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Other objects and features of the present invention will become apparent from the following detailed description considered in connection with the accompanying drawings, which disclose one embodiment of the invention. It is to be understood, however, that the drawings are designed for the  
15 purpose of illustration only and that the particular description of the chosen application of the remote asset management system and method is given by way of example only and does not limit the scope of the invention.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

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FIG. 1 illustrates a schema showing the layout of the wireless module according to the present invention.

FIG. 2 illustrates a schema showing an example of a number of the applications controlled by the wireless modules according to the present  
25 invention.

FIG. 3 illustrates a schema showing the remote asset management system according to one embodiment of the invention.

FIG. 4 illustrates a schema showing a flow diagram of how a message may be sent and systematically processed by the wireless module according  
30 to the system and method of the present invention.

## DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now in detail to the drawings and in particular to FIG. 1 thereof, therein illustrated is a wireless module, which forms part of the remote asset management system according to one embodiment of the present invention.

The following description makes reference to the detailed features and applications as outlined in the objects of the invention.

In Figure 1 is shown a wireless module (10), which comprises a telecommunications chipset (20) and antenna (30), a GPS chipset (40) and antenna (50), a data processing means (60), a memory module (70), a rechargeable battery (80), and a port module (90). The telecommunications chipset (20) also comprises a ringing tone generator. A microphone and loudspeaker may be incorporated into the wireless module or a microphone and audio headset may be connected to a dedicated port in the port module (90). A light emitting display means (100) such as one or more light emitting diodes (LEDs), which indicate the status of the wireless module such as its current mode of operation. Different sequences of LEDs and different coloured LEDs may be programmed to indicate that the wireless module is functioning correctly, or is receiving data, or is retrieving data from an associated asset, to which it is connected or integrated via the port module (90).

The data processing means (60) comprises a micro-controller and a software module, which is programmed with a data processing asset management application to manage the asset through the port module (90). The data processing application processes SMS messages received by the telecommunications chipset (20) via the antenna (30) and authenticates the incoming message against stored subscriber data in the memory module (70). Authenticated messages are further analysed for data and or for asset management instructions.

The data processing means (60) provides the capability to transform the wireless module (10) from being an end point of data or voice communication into being a programmable gateway, which is able to communicate with a range of external devices or functional elements connected via the port module (90).

Figure 1 also shows an asset interface module (110), which is associated with an asset (120) that the wireless module is managing and which makes possible direct communication between the operational control system of the asset and or data collection system of the asset (130) and the wireless module (10).

The data processing means (60) sends data and instructions to the port module (90) for communication to the asset interface module (110). The port module (90) comprises a number of analogue and digital ports (92), a power supply port (94), a fixed line telecommunications port (96), a serial interface (97), a USB connection (98) and a laptop connection port (99). A Telecoms microphone and audio headset may be connected to the port module via a dedicated connection (95).

The analogue and digital ports (92) comprise voltage input and output lines, which can receive data from and send data to the asset interface module (110) for communicating with the asset. The power supply port (94) can receive power directly from the asset itself via the asset interface module (110) or via a separate mains power supply (82) or a separate power supply (84) such as a solar cell. The fixed line telecommunications port (96) is used to connect the wireless module to a local area network (86) or directly with the Internet (88) and it may comprise a firewall capability to prevent unauthorised access. Additional serial and USB interfaces are provided to connect different devices for different applications.

The wireless module may draw its power from one of a number of power sources (80, 82, 84, 110). To conserve power, the wireless module (10) further comprises a programmable power supply duty cycle module (200). The module (200) can be programmed to separately control the power supply to the telecommunications chipset (20) and GPS chipset (40). The GPS chipset (40) uses large amounts of power to process GPS coordinates and the telecommunications chipset (20) uses large amounts of power to maintain communication with the telecommunications network. It is therefore advantageous to provide the means (200) to power down either the GPS chipset (40) or the telecommunications chipset (20) or both whenever either of these elements of the module is not needed for position determination or for wireless communication respectively. The programmable power supply duty cycle module (200) is associated with a timing circuit and it (200) comprises the means to maintain the wireless module at a low power.



In this way the wireless module can receive and authenticate incoming messages when in an active mode which can cause the wireless module to power down for a predetermined interval into an idle mode state. During the said interval, it is not possible for the device (10) to send or receive wireless communications via the antenna (30) and chipset (20). During the said interval, it is not possible for the device (10) to process GPS data and determine its geographical coordinates.

For location determination applications, the device (10) has the capability to be programmed to store GPS data periodically according to a certain period. The data is stored in the memory module (70) for the purpose of creating a tracking log of the movement of the device. Even when there is no satellite visibility, it is often possible to communicate via mobile phone. In such an instance, the device can be requested to send the tracking log to another wireless device or to a system server at a remote location.

The tracking log comprises a number of GPS coordinate data and the time when each data was stored. In this way the track of previously stored GPS position fixes may be used to predict the current location of the device.

The programmable power supply duty cycle module (200) is able to selectively control the power supply to all parts of the wireless module according to the pre-programmed duty cycle and also according to data received from the port module (90). The associated asset may generate an alarm condition and request that data be sent immediately to the remote system server or to some other remote device such as a wireless device or a remote device connected via the Internet. If the module is in idle mode when the alarm message is received, the data processing means (60) can communicate with the power supply duty cycle module (200) and cause the device to power up the telecommunications chipset so that an alarm message can be sent across the mobile telecommunications network to a remote wireless device. If the remote device is connected to the Internet via Internet connection port (96), then the wireless module may send an alarm message to a destination IP address without powering up the telecommunications chipset (20).

The wireless module is intended to comprise different variants wherein each variant is optimised to match the asset management requirements of each associated asset. A remote system server service platform is used to process a range of responses sent by the wireless module.

In a first embodiment, the service platform communicates using SMS messages wherein each comprises a string of up to 160 characters. It will be apparent that the server platform may also and alternatively comprise  
5 another wireless module, which is able to serve as a master wireless module to supervise the asset management operations of one or more slave wireless modules.

The data processing means (60) provides the capability to transform the  
10 wireless module (10) from being an end point of data or voice communication into being a programmable gateway, which is able to communicate with a range of external devices or functional elements connected via the port module.

Figure 2 illustrates the different applications controlled by the wireless module in the particular example where the mobile telecommunications network operates according to the GSM standard. It will be clear to those skilled in the art, which changes must be made to the wireless device and to the messaging protocols in order for the system and method of the current  
20 invention to operate according to other telecommunications systems and standards such as for example GSM GPRS, CDMA 2000 and WCDMA.

In more detail, Figure 2 illustrates the use of the asset management system according to the current invention. Each wireless module (10)  
25 comprises the capability to communicate via the mobile telecommunications infrastructure (400). A mobile phone or message-enabled wireless terminal (170) can communicate with a specific wireless module (10) or with a system server service platform (150) via a point of inter-connection (160) with the mobile telecommunications infrastructure (400).

30 For asset management applications, which comprise a small number of wireless modules (10), it is possible to manage these using a laptop PC (140).

35 The wireless module (10) is capable of controlling many system operation variables of the associated asset such as an asset operating system, an electronic control system, an electromechanical servo, a stepper motor, an electricity mains switch, a thermocouple and a means to access or update data (310).

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The wireless module has the capability to be integrated with a utilities meter such as a water flow meter (300) wherein water usage data can be remotely accessed from the wireless module integrated with the utility meter and forwarded to the water board.

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In the example of GSM, figure 2 illustrates that communications can be sent to the wireless module, either directly from any compatible wireless device having SMS capability or via a message-processing system-server service-platform. For each specific asset management software application, a separate asset management service is operated by the service-platform. All parameters defining and controlling the operational characteristics of each managed asset are stored and controlled by a specified asset management software application. In addition, ranges of acceptable operating conditions are also stored and controlled by the said software application such that alarm conditions are established when any operating conditions move outside any of the corresponding acceptable ranges of operation.

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The remotely located system-server service-platform receives data relating to any specific remotely located asset either directly from the wireless module in response to a status request interrogation message sent to the wireless module associated with the said asset or periodically and automatically according to a predetermined and pre-programmed data generation period. In addition, the service platform also receives data describing an alarm condition in the case when the associated asset moves outside the acceptable range of operating conditions and generates an alarm to be sent to the wireless module, or the wireless module itself determines that an alarm conditions exists. Depending upon the complexity of the asset monitoring application, either the wireless module establishes the alarm condition, or the associated asset informs the module of the alarm condition.

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Communications between the associated asset and the wireless module are consequently periodic, or in response to a received wireless data message such as an SMS message, a data call, or a packet data message such as GPRS, or in response to a fixed line data message such as a stream of IP packets in the instance where the wireless module may be additionally connected to the Internet via one of the port module interfaces, or when a functional element generates an alarm condition.

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To further understand the actions performed by the data processing means (60) of figure 1, in one preferred embodiment, which makes use of SMS messaging, the data processing application contained within the data processing means (60) comprises the following functional capability.

1. A Reprogrammable Permitted Callers List wherein incoming SMS messages comprising a security code and a permitted subscriber number and a subscriber preference number enable the module to build up and store a list of permitted numbers in the order of descending preference number.
2. A reprogrammable call reject feature wherein incoming calls must be in 'own number sending' mode and are checked against a look-up table and are rejected if they are not stored in the 'permitted callers' list.
3. A subscriber 'reselect if unavailable' feature wherein if the call is not established within a default period or if the dialled number is engaged, the module reselects the next number on the 'permitted callers' list.
4. A wireless data message translation feature wherein incoming SMS or data call messages are validated as having come from callers on the 'permitted callers' list and then further processed to verify that the calling subscriber, also known as the A subscriber, is authorised to access each of any specified data that the said SMS message is requesting access to, or is authorised for directly communicating with one or more of the designated externally-connected asset control systems, or is authorised to access the current GPS coordinate data or to any stored data such as the stored GPS data.
5. A non-permitted caller ID store feature wherein calls and messages originating from an A subscriber not on the permitted callers list will be stored in a 'non-permitted callers' list. Furthermore, all calls and messages from an A subscriber with 'own number sending' switched off are automatically rejected. To avoid storage of spam advertising messages, the content of the rejected message may not be stored.

- 5 6. A reprogrammable port module processing function wherein each of the analogue and digital input lines which connect the wireless module to one or more of the assets via each asset's interface module (110) is able to be addressed by the data processing application such that data may be read and processed by the application. For each of the externally connected assets there exists a programmable sub-application which directly maps the range of data values generated by the asset operating system to a range of status conditions such as 'normal operation', 'alarm condition', 'change in operation' and the like.
- 10 7. A number of programmable sub-applications wherein each sub-application comprises a set of data attributes which enables the wireless module to read data from and write data to the asset interface module (110) or to read data from the GPS chipset or from the GPS stored data. The sub-application further specifies reprogrammable access rights to one or more of the data attributes associated with the external asset or to the GPS stored data.
- 15 8. An alarm condition in the programmable sub-application wherein for each of the sub-applications, there exists a programmable alarm feature, which generates a message if the data values generated by the associated assets are outside operating conditions. For each alarm condition there exists an associated 'B-Subscriber' to which the message is directed, or an associated E-mail address as well as a pre-programmed alarm message. User-definable alarm messages and status messages are stored in a specific memory block and map to specific data ranges read from the port module. For different alarm conditions there exists a link to the 'reselect if unavailable' feature.
- 20 25 30 9. A data-access-feature in the programmable sub-application wherein for each sub-application, there exists a data-access-feature, which enables a permitted 'A subscriber' to access real time and or stored data for one or more sub-applications.
- 35

10. A stored data profile feature wherein for particular applications, such as those monitoring a range of data values changing with time, the wireless module comprises sufficient memory for the particular application to enable it to store a user-definable set of data values.  
5 The set of data values may be accessed by a permitted 'A subscriber' and sent by SMS if less than 160 characters or by data call if the data set is large. The incoming 'A-subscriber' message indicates the number of stored data values requested, and or the range of time during which the data values were stored, as well as the preferred data  
10 reply format.

11. Application monitoring feature wherein the data processing application (DPA) generates a real time set of data values indicating the status of all external assets controlled by the DPA such that a  
15 laptop PC or the like can be connected directly to one interface of the wireless module so that its functionality and real-time operation can be visualised.

20 Note that it is well within the functionality of the wireless device to be programmed to dial up a dedicated connection in the case that a data call must be made or to establish a voice connection. Furthermore, voice recognition software may be stored in the wireless device and used to control certain functionality of the asset management process. A dedicated  
25 voice link may be made to a remote server to enable a person at a remote location to speak into the voice channel, which is subsequently received and processed by the voice recognition software in the wireless module and linked to a specific asset management task such that voice commands may cause remote asset management tasks to occur.

30 When the wireless module (10) is receiving messages or generating alarms, the wireless module provides a real-time visualisation of its operation. A series of LED diodes of different colours and or of different illumination sequences, enable a user to verify that the module is  
35 functioning correctly without needing to connect a PC to the PC interface in the port module. The LED diodes show simple functionality conditions such as:

1. Call-reject wherein a red diode is illuminated for 1 second;

2. A-Subscriber recognised and message accepted wherein a green diode is illuminated for 1 second.

The following conditions may have different LED responses:

3. Data-Access permitted;
- 5 4. Data Access not permitted for recognised A-Subscriber;
5. Reprogramming of linked subscriber number;
6. Self-Check of unit;
7. Access Confirmation to programmed external functional elements;
8. Alarm condition;
- 10 9. GPS coordinate generated;
10. GPS coordinate read from last stored entry due to no GPS position fix currently available;
11. Module within base station coverage;
12. Module outside base station coverage.

- 15 In an alternative embodiment the wireless device may comprise a fibre optic display such that the LED display may be replaced or complemented with one or more rings of light emitting fibre to generate rings of light of different diameters and patterns and colours to differentiate the above list of functionality conditions. Alternatively, the wireless device may be
- 20 complemented with coverings of light emitting polymers, which are capable of generating diverse and multicoloured smart-skin effects, wherein the patterns for each may be controlled by the data processing means.

- 25 The wireless module comprises the capability for a personal computer such as a laptop PC to be directly connected to it via a dedicated port for detailed visualisation of its real-time processing capability and for reprogramming purposes. Sufficient application security such as an exchange of coding keys between the DPA and the attached laptop exists at the laptop interface to prevent unauthorised access of the data.

For remote, hard-wired access, the data processing application has the capability to run a virtual private network (VPN) programme end-to-end between the wireless module firewall and a remotely located device connected to the Internet.

- 5       The laptop PC software will comprise pull-down menus to access the real-time data available to the data processing application such as data values returned by each interface in the port module and stored data values based upon a specific data storage period and maintained for a specific time window for example, the last 60 data values, stored per minute, where new  
10      data replaces the first stored entry.

- For different applications of the wireless module, the laptop PC connected via the port module (90) comprises a specific script-based software to enable a user to program specific cause-effect functionality into the said module. In this way a user can build an application on the laptop PC  
15      and upload this to the module.

To assist with the application development and for visualising the real-time functionality of the wireless module, the laptop PC connected via the port module (90) shows a screenshot depicting the processing and data storage functions being performed by the wireless module.

- 20      The following application monitoring details are present on the screenshot of the wireless module:
1. A wireless module self check status which includes a list of the features of the wireless module and the memory size available to different associated assets for periodic data storage;
  - 25      2. A port module self-check status, which comprises a list of the current standard, interfaces in the port module and the current data values of the voltages on each;
  3. A stored data values, which comprises a table which can convert to a simple graphic of stored data values for the associated assets and a  
30      table of the previously determined GPS coordinates, indicating periodicity and over which time data values were stored;



4. A permitted callers' list, which comprises a reprogrammable and hierarchical list indicating the B-subscriber number and or the IP address to which the wireless module will call or send data messages to. This list also specifies the status of permitted callers and the access rights to particular associated assets and to the stored data;
5. An access code list, which comprises a list of different user-definable SMS access codes, which must be included within each SMS message for access/control of different features of the module or for access/control of any associated asset;
6. An associated asset functional description which describes the functionality of the attached device;
7. A status message list which comprises a list of user-definable messages which relate to the ranges of parameters monitored by the DPA of the externally attached associated asset, which include alarm condition messages as well as current operational messages and intervals of time that a specified monitored associated asset has been working within an acceptable operating range;
8. A power supply status, which shows whether the module is currently being powered by the external device or whether it is drawing power from its own battery, as well as the power level of the rechargeable battery.

Other asset features, which are specific to a particular application of the wireless module, will also be included in the screenshot.

## DESCRIPTION OF A SECOND EMBODIMENT

In a second embodiment of the same invention, particular details of the system and method according to the application to vehicle guidance systems are now described in more detail. As mentioned, the wireless  
5 module has the capability to receive and store data for the purpose of updating data stored in the memory of an associated asset. In the particular example of the GPS vehicle guidance system, the in-vehicle GPS system calculates a position fix from the transmissions received from a number of satellites in the moving constellation of GPS satellites. This position fix is  
10 computed in the form of a geographical coordinate and compared with the coordinate-encoded map data in the vehicle guidance system. In order for the system to be useful, the map data must be up to date. According to the invention, as new roads become opened and knowledge becomes available of planned road works, it is advantageous that this data is transmitted using  
15 the mobile network infrastructure in the form of messages sent to the wireless module. In addition, statistical information about traffic congestion at specific times of the day and during the year can be forwarded to the wireless module associated with the in-vehicle GPS system. Such data may be communicated using messages, such as the GSM SMS message protocol,  
20 or via GPRS, at times when the network is least congested such as at night.

Real-time updates such as slowing of traffic flow rates, traffic jams, and accidents, and changes in driving conditions due to adverse weather conditions may also be communicated using the same system and method. Drivers could, for example, request traffic information about their current  
25 intended route from a remote server connected to the mobile network infrastructure using the wireless module to request real-time information by sending the coordinate details of the planned route as calculated by the in-vehicle system. Alternatively, and with particular reference to this application, it is advantageous to describe an auxiliary system and method,  
30 which falls within the scope of the current invention.

While it is effective and efficient to communicate slowly changing route data to update the roadmap data in all route-guidance systems, it is less efficient to send real-time data, which describes traffic congestion  
35 events of short duration, to all drivers when such data only impacts drivers who are currently in or near the location of the said event at the time it occurs.

It is possible for a remote system server to interrogate the in-vehicle wireless module GPS data and then react by transmitting real-time congestion data back to those vehicles in the vicinity of each event.

- 5 However, the auxiliary system and method according to this application of the invention is more appropriate.

10 The infrastructure for communicating traffic news to drivers is well established in many countries. Moreover, it is developed to the extent that drivers generally receive information, which relates to the area through which they are travelling. Many drivers listen to FM public radio broadcasts from local radio stations while travelling. Moreover, certain of these car radio systems comprise appropriate functionality such that traffic congestion announcements can periodically interrupt these local broadcasts to inform  
15 the driver of areas of traffic congestion or adverse driving conditions due to an accident or bad weather. In this way, drivers who are travelling in the vicinity of the said congestion events can receive meaningful traffic congestion announcements.

20 In addition to these known systems, many Frequency Modulated FM public radio broadcasts comprise digital information such that simple advertising messages appear on the car radio display. This capability is not presently used as a means to transmit traffic congestion information. The auxiliary system and method involves making use of the interrupting traffic  
25 announcement broadcasts and the capability to encode radio broadcasts with data.

The auxiliary system and method according to the invention makes use of these traffic announcements in such a way that the public radio station  
30 traffic announcements are modified to comprise encoded data messages incorporated into the radio transmission, which describe details of the event in a way that they can be utilised by a vehicle guidance system. The said encoded data messages are received and decoded by a separate FM decoding device, which is enabled to receive traffic announcement  
35 broadcasts, wherein said FM device is associated with the wireless module according to the invention, or wherein the wireless module comprises such an FM decoding means, or wherein the said encoded data messages are decoded and output by the car radio itself and sent to the wireless module or directly to the associated in-vehicle navigation system, such that real time  
40 traffic information can be transmitted to the in-vehicle navigation system.

In this way, the auxiliary system and method makes it possible for the wireless module according to the invention to update an associated in-vehicle GPS car navigation system with map data and localised real-time data relating to traffic congestion events. The said navigation system is thus able to make use of this additional information and guide drivers away from traffic queues due to an accident or other congestion event. The on-board system could process the information and if it impacted the planned journey route, the system could issue an alarm and request that the driver turn off the current road according to the normal practice of using such vehicle guidance systems.

With particular reference to Figure 3, the illustration indicates the communication paths of the different types of data. A GPS data server (190) supervised by a computer system such as a laptop PC (140) is connected to the mobile network infrastructure (400). The GPS data server (190) has a list of the subscriber numbers of each of the wireless modules (10A) associated with each in-vehicle GPS vehicle guidance system (500). GPS data updates can be sent from the GPS data server (190) via the mobile network infrastructure using telecommunication messages to the wireless module (10A) associated with the GPS vehicle guidance system (500).

Real-time traffic data is sent by local FM public radio station traffic broadcasts. In one embodiment, the wireless module (10A) comprises additional functionality of a traffic announcement enabled FM chipset. As mentioned earlier, this functionality may be external to the wireless module or a separate FM car radio may be used to decode the FM broadcasts.

It will be obvious to those skilled in the art to apply this system to emergency service vehicle applications wherein each vehicle comprises the wireless module according to the invention and wherein real-time event data can be communicated via SMS, or to all vehicles over a common radio broadcast channel. Correspondingly, such an application falls within the scope of the current invention.

## DESCRIPTION OF FURTHER EMBODIMENTS

It is to be understood that not all interfaces will be present on each and every module according to the present invention and choices of the different interface types are made according to the particular asset type and the asset interface (110). Furthermore, the specific functional split of the total functionality of the wireless module across the particular elements is given by way of example only and that different variants of the design are possible which integrate different processing capabilities of the module with different hardware elements. For example, the asset interface (110) itself may further comprise a processing means, which is capable of processing data generated by the asset operating system or asset data collection scheme. For example, in the application of the wireless module to utility meters, the communication channel from the asset (120) to the wireless module (10) via the interface (92) may comprise sending data only.

In particular, and in accordance with the scope of the invention, the data processing means (60) may exist as a single separate module or exist as a number of functional software elements, spread out among different parts of the module. The wireless module itself may comprise a programmable software radio module instead of a specific dedicated Telecoms chipset.

As described earlier, the wireless module (10), which may incorporate a telecoms chipset according to the GSM standard, may, in one embodiment, make use of SMS messages to effect asset management of an associated asset. The following description gives an example of an SMS message format, which can be used to achieve the objects of the invention. It is to be understood, however, that this is only one example of many which may be used, wherein each may be adapted to suit each different application.

The wireless device is designed to process SMS messages according to a predetermined format. The DPA means (60) performs the processing of the incoming SMS message. The format may comprise the following:

1. A 160 character message comprising a coded identifier such as an identification code and or including data describing from which originating device the message was sent such as that sent by a mobile phone in 'own number sending' mode;

2. The message further comprises an authorisation code, which may be different to provide different levels of access to data stored by the device.
- a. A first level of access may represent authorisation to change the default subscriber number that the device communicates with in the instance of an alarm;
  - b. A second level of access may represent authorisation to access the GPS data stored by the memory module (70);
  - c. A third level of access may comprise two or more codes wherein the first represents authorisation to access different functionality of an associated asset and the second and additional codes define the specific functionality which may be accessed and changed.
3. The message further comprises a data block which specifies the particular asset management tasks performed by the wireless module upon the associated asset such that data is read from or sent to a specific functional element within the associated asset via the port module (90) for the purpose of determining the status of that functional element or for effecting change in that functional element.

The data processing means is fully programmed with the capability to communicate with each and every functional element within the associated asset. The specific data describing the operating system of the associated asset and data which relates to the method by which asset data is accessed and read by the wireless module (10), following authentication of the sender of the message and validation of the access authorisation, is stored in the memory module and is available to the data processing means (60).

Consequently, each coded message comprises a predetermined format which is fully processed by the data processing means (60) with reference to the stored data in the memory module (70) and, in the case that the message is authenticated and authorised, the data component of the message is processed to access data from a specific memory location of the wireless module or associated asset and or to effect a specific change in the said wireless module or associated asset. In this way the data processing means (60) and the controlled access of information through the port module (90) are key to the system and method of the invention.

Figure 4 illustrates 7 steps how an asset control message may be authenticated and authorised to control some functionality of an asset associated with the wireless module (10) according to the current invention.

5        With reference to the preceding description, it will be clear to those skilled in the art that the level of authentication and or authorisation will be directly related to the particular asset management application.

10        In more general terms, the invention provides a solution for switching off devices remotely and rendering them inoperable, such as laptop computers and thereby preventing unauthorised access of stored data. In other situations, the operational characteristics of the asset, such as a car engine performance, can be monitored remotely, and provided to a vehicle service centre for analysis. Moreover, the same in-vehicle module can  
15        provide positional information, by way of an integrated Satellite Navigation Global Positioning System chipset, as well as affording the capability to lock down the vehicle control system when the vehicle is stationary.

20        In other applications such as where a wireless module can be used to communicate with a server, or where a system server is connected to the mobile telecommunications infrastructure the same server based remote asset management system can provide consumer services such as the means to program solid-state digital video broadcasting DVB-T recorders.

25        In such a service, for example, a consumer can register the make and model of their solid-state video broadcasting device and their interest in a certain type of television programme with the network-based server. At any time during the day, the consumer may receive a data message on a mobile phone or via E-mail indicating that a potentially interesting programme will  
30        be broadcast, and the request whether the network based server should communicate data instructions to the wireless module associated with the digital video recorder to record the broadcast. For example, the consumer need only reply with a simple message and the network-based server can proceed to compile and communicate the complex data message to the  
35        wireless module associated with the said recorder.

In the area of remote facilities management, the remote asset management system provides a solution for an improved fire alarm and home security network for communicating directly with homeowners or directly with the emergency services in the case that there may be a fire at the location or when an unauthorised intruder has been detected.  
Furthermore, the same wireless local area network can be extended for the remote control of diverse consumer devices. A wireless telecommunications based fire alarm provides the means to achieve intelligent fire surveillance in areas where only radio network coverage is possible such as in remote areas where no fixed telecommunications infrastructure is present.

In addition to the provision of network-based remote asset monitoring systems, the invention also provides a telecommunications solution for determining the location of sought assets as well as the authentication of assets, vehicles and persons.

The invention may make use of the existing wireless telecommunications infrastructure such as that operating according to the GSM Telecoms standard or the WCDMA Telecoms standard as well as the pager network.

The module-server architecture operates seamlessly and transparently with the existing wireless networks, thereby making the remote asset management service available wherever there is wireless network coverage. Furthermore, the invention may make use of the text message service provided by the wireless telecommunications networks such as the Short Message Service in GSM. In this way, asset management commands can be sent easily and efficiently between each wireless module associated with the asset and the network-based server. Moreover, the choice of SMS enables any person who is authorised to communicate with the asset, to communicate with the network server and or the asset wireless module from an SMS-enabled mobile phone, an SMS-enabled wireless PDA, or via an SMS-message despatch internet website.

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40



The Short Message Service (SMS), as defined within the GSM digital mobile telecommunications standard has several unique features:

- 5       • A single short message can comprise up to 160 characters of text in length. These 160 characters may comprise words or numbers or an alphanumeric combination. Non-text based short messages (for example, in binary format) are also supported and these may be used for ring tones and logos services for instance.
- 10       • The Short Message Service is a store and forward service where short messages are not sent directly from sender to recipient, but are always sent via an SMS Centre instead. Each mobile telephone network, which supports SMS, comprises one or more messaging centres to handle and manage the short messages.
- 15       • The Short Message Service features confirmation of message delivery. Unlike paging, users do not send a short message and trust and hope that it gets delivered. Instead, the sender of the short message may receive a return message back notifying them whether the short message has been delivered or not.
- 20       • Short messages may be sent and received simultaneously with GSM voice, Data and Fax calls. This is possible because whereas voice, Data and Fax calls occupy a dedicated radio channel for the duration of the call, short messages are transmitted using the signalling channel. As such, users of SMS rarely, if ever, get a busy or engaged signal as they can do during peak network usage times.
- 25       • Ways of sending multiple short messages are available. SMS concatenation (stringing several short messages together) and SMS compression (getting more than 160 characters of information within a single short message) have been defined and incorporated into the GSM SMS standards.

30       To use the Short Message Service, subscribers require the relevant subscriptions and hardware, specifically:

- A subscription to a mobile telephone network, which supports SMS;
  - The use of SMS must be enabled for that user (automatic access to the SMS service is given by some mobile network operators, others charge a monthly subscription and require a specific opt-in to use the service);
- 35

- A mobile phone, which supports SMS;
- The knowledge of how to send or read a short message using each subscriber's specific model of mobile phone;
- 5     • A destination subscriber number or IP address to where a short message is sent, or from where a short message is received. This may be another mobile phone, a fax machine, a PC or via an SMS emulating website Internet address.

10     Many different types of mobile networks support the use of SMS.

10     Since its inclusion into the GSM standard, SMS has also been incorporated into many other mobile phone network standards, including the Nordic Mobile Telephone (NMT), Code Division Multiple Access (CDMA) in North America and Personal Digital Cellular (PDC) in Japan. Each of these  
15     standards implements SMS in slightly different ways and message lengths do vary. The availability and characteristics of SMS on different mobile network standards is now quite widespread.

20     SMS is fully available on GSM 900MHz, GSM 1800MHz, and GSM 1900MHz, for message lengths up to 160 characters. SMS is also available on the analogue NAMPS system of North America, and the CDMA system of North America but with an increased message length of 256. US TDMA and D-AMPS of North America also have SMS. In Japan, both the Personal Handyphone System (PHS) and the Personal Digital Cellular  
25     standard PDC have SMS capability.

30     The system and method according to the invention may be thus implemented on US TDMA networks (IS-136), CDMA networks (IS-95) and all GSM networks. In addition it may be used wherever IDEN or an Integrated Digital Enhanced Network is in operation, which is a TDMA-based digital network standard, which supports up to 140 character SMS messages.

35     In addition to these applications where SMS capability forms part of the existing voice and data mobile telephone infrastructure according to the previously specified standards, the system and method according to the invention is equally suitable for GPRS packet radio networks and 3<sup>rd</sup> generation networks. In addition, wireless Application Protocol, or WAP technology, may be used to build server-based messaging applications.

5      Pager messaging networks may also be used as the messaging carrier infrastructure instead. In all cases, persons skilled in the art will be familiar with the necessary changes, which must be made to the wireless module Telecoms chipset (20) and the software operating on the data processing means (60). Instead of a reprogrammable power supply, a wireless module may comprise a NICAD battery to provide sufficient power to be able to send a message or establish a dedicated voice channel to another wireless device.

10      The present invention may be used in a diversity of applications and environments. In particular, the application of advances in messaging such as EMS (Enhanced Messaging Service) and MMS (Multimedia Messaging) are fully within the scope of this invention. For example, a multimedia message comprising a graphic image may be generated by an MMS enabled  
15      wireless module to transmit stored data in a graphic form. Furthermore, it should be understood that the present disclosure is for the purpose of illustration only and does not include all modifications or improvements, which may fall within the scope of the appended claims.

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## Claims

1. A remote asset management system comprising a fixed remote operator centre comprising a remote system server service platform (150), said remote asset management system further comprising a network of programmable wireless modules (10) communicating via a standard radio communication protocol, each of said programmable wireless modules (10) being linked to one or a plurality of fixed or mobile assets (120) to be remotely managed wherein programs, commands, parameters, and status data pass through said network of programmable wireless modules (10), each of said programmable wireless modules (10) further comprising an identification module, a telecommunications chipset (20) comprising an antenna (30) to communicate via a mobile telecommunications infrastructure (400) said telecommunication chipset (20) further comprising means for communicating via a standard wireless telecommunication network being either GSM (global system for mobile telecommunication) or GPRS (general packet radio service) or CDMA (Code division multiple access) or WCDMA (wide band CDMA) or CDMA2000 or WLAN (wireless LAN) or PDC (Personal Digital Cellular) or a pager network, or via a satellite telecommunications system, said programmable wireless modules (10) further comprises means (100) indicating the current mode of operation of said programmable wireless module (10), a data processing means (60) comprising a micro-controller and a software module, a FLASH memory and a memory module (70) and further comprising a power supply being supplied externally or via a battery (80), said remote asset management system being characterised in that:
- said remote system server service platform (150) comprises a dedicated software for remotely programming said network of programmable wireless modules (10) via said standard radio communication protocol and/or via a LAN, with one or a plurality of same or different remote assets management applications or personal security applications and for causing said programmable wireless modules (10) to pass data to and from one or a plurality of said linked fixed or mobile assets (120) for remotely

configuring, testing, monitoring and controlling one or more linked fixed or mobile assets within said network of fixed or mobile assets (120), and

5       said remote system server service platform (150) further comprising means for servicing a plurality of subscribers for remotely managing a different set or subsets of fixed or mobile assets (120) on behalf of each of said plurality of subscribers, and

10       said remote system server service platform (150) being further linked to one or a plurality of fixed and/or mobile local system server service platforms comprising means for servicing part of said plurality of subscribers for remotely managing one or a plurality of said subsets of fixed or mobile assets (120) on behalf of said remote system server service platform (150) further  
15       comprising the functionality of one of said programmable wireless modules (10) and a computer integrating the set of operating, planning and management functions modules.

2.       A remote asset management system according to claim 1 wherein  
20       each of said one or a plurality of local system server service platforms further communicating to said remote system server service platform (150) via said standard radio communication protocol and/or via a LAN to communicate via either a web page or via E-mail or via IP packets, and

25       each of said one or a plurality of local system server service platforms being a master for managing one or a plurality of slave programmable wireless modules (10) forming one of said subsets of fixed or mobile assets (120) each dedicated to the same global task of remotely monitoring one or a plurality of said same or  
30       different fixed or mobile assets (120) according to one or a plurality of said applications.

3.       A remote asset management system wherein said local and/or remote system server service platform (150) comprising means for  
35       configuring and testing each of said set or subsets of programmable wireless modules (10) and their respective associated same or different fixed or mobile assets (120) according to claim 1 or 2 wherein;

said local and/or remote system server service platform (150) further comprising;

means for remotely initiating said respective set or subsets of said programmable wireless modules (10) by sending to said  
5 identification module of each of said programmable wireless modules (10) a unique encrypted code (PUK) to allow said local or remote system server service platform (150) to put each of said programmable wireless modules (10) in a programming mode, and

means for broadcasting a first list of one or a plurality of  
10 hierarchical privileged access codes to each set or subsets of said programmable wireless modules (10), said access codes being either whether mobile or fixed telephone numbers and/or PC or IP addresses, of different authorised personnel and/or subscribers to remotely access said set or subsets of said programmable wireless  
15 modules (10) and their linked one or a plurality of same or different assets, and

means for broadcasting a second list of one or a plurality of telephone numbers and/or PC or IP addresses of same or different authorised personnel and/or subscribers for said programmable  
20 wireless module (10) to be called either on request and/or when paged by said pager network and/or periodically and/or in case of emergency for transmitting status and alert or alarm reports according to said remote assets management application requirements for;

25 allowing said different authorised personnel and/or subscribers to remotely access said one or a plurality of said programmable wireless modules (10) and/or one or a plurality of fixed or mobile assets (120) respective supervision and/or diagnostic data according to his privilege level, and further  
30 comprising means for putting each of said programmable wireless modules (10) in an asset programming mode, and

means for broadcasting a third list of the data type and capabilities of same or different or one or a plurality of fixed  
35 or mobile assets (120) wherein said data types being asset type and/or model number and/or OS type and/or power supply and/or battery supply and/or duty cycle parameters of wake up versus sleep mode duration and/or enabled or disabled asset functionality and/or location data and/or service history and/or location

history and/or performance optimisation and/or security lock-down features and of said parameters information wherein said parameters information being about corresponding services, maintenance, operating modes and emergency procedures in order to download said parameters information to each corresponding one or a plurality of fixed or mobile assets (120) in order to report back formatted status information regarding each of said or one or a plurality of fixed or mobile assets (120) to said local and/or remote system server service platform (150) in order to automatically integrate said reported formatted back status data in directly workable different dedicated spreadsheet documents and/or web pages for;

allowing said set of said programmable wireless modules (10) information data to be presented with all their subsets of said programmable wireless modules (10) for either operational purposes and/or technical diagnostic and/or maintenance planning and/or billing and/or balance sheet and/or schedule of assets and/or ordering goods wherein each of said status reports are sent accordingly to one or a plurality of telephone numbers or PC or IP addresses of said subscriber and/or maintenance team and/or security team and/or to said local and/or remote system server service platform (150), in order to provide each service being either technical or administrative or security and/or the subscriber with the unique data they need and for archiving and processing said status data automatically in real time, and means for putting each of said programmable wireless modules (10) in an operational mode, and

means for broadcasting said information data simultaneously to each of said set or one or a plurality of said subsets of said fixed or mobile assets (120) each being part of the same application and needing same said first and/or said second and/or said third list for forming an operational set or subset of fixed or mobile assets (120) sharing measured data in order to synchronise their actions to globally achieve said application.

4. A remote asset management system according to claim 3 wherein said programmable wireless module (10) further comprising;

means for receiving encrypted digital data via GPRS or in the form of data call or of one or a plurality of concatenated short messages of the SMS sort or E-mails, said encrypted digital data comprising said commands and request for said fixed or mobile assets (120) and an encrypted security code, and

means for authenticating said received encrypted security code against authorised personnel or subscriber codes from said stored first list for granting access and/or control of all or a selected number of authorised asset appliances according to said privilege level, and

means for transmitting encrypted digital data via GPRS or in the form of data call or of one or concatenated short messages of the SMS sort or E-mails to prioritised numbers and/or PC or IP addresses stored in said second list, and

means for downloading said commands and corresponding parameters representing the operational features from said third list to one or a plurality of said fixed or mobile assets (120) to which each of said programmable wireless modules (10) is wirelessly linked and/or wired, wherein said third list comprising a plurality of application-useful data lists wherein said application-useful data lists comprise of out-of-range conditions and/or basic troubleshooting solutions and/or alert conditions and/or high priority alarm, and/or

means for establishing a voice connection comprising a voice recognition software to recognise voice commands and a voice code and its associated privilege level and execute said voice commands associated tasks, and means for broadcasting stored voice messages to a number from said second list allowing only bi-directional data flows and/or allowing a two-way voice communication, and/or

means for positioning (40) said programmable wireless modules (10) comprising an antenna (50) for tracking the location of said associated mobile asset (120), and/or

a port module (90) connecting said programmable wireless modules (10) to a range of external assets or asset appliances or functional elements by means of one or a plurality of analogue and digital ports (92), said port module (90) further comprising a power supply ports (82, 84), a fixed line telephone port (96),



- a serial interface (97), a USB connection (95), a computer connection port (99), a PCMCIA PC card port or a firewire connection, a SCSI port for connecting a hard disk drive (HDD), and a microphone and audio headset connections (95), and
- 5     said analogue and digital ports (92) further connecting said programmable wireless modules (10) to a remote asset interface module (110) communicating with one or a plurality of said fixed or mobile assets (120), via a wired or wireless connection.
- 10    5. A remote asset management system according to claim 4 wherein said programmable wireless modules (10) further comprising;
- means for transmitting and storing requested data and/or periodically received data from said linked one or a plurality of said assets and/or emergency data of functional status and/or
- 15    alarm and/or asset hardware anomaly in real-time for management and security purposes and means for transmitting said data to one of said local system server service platform and/or to said remote system server service platform (150), and
- means for reporting in real-time said formatted functional
- 20    status and/or said alarm and/or said asset hardware anomaly information requiring an intervention and means for broadcasting said information to one or a plurality of telephone numbers and/or PC or IP addresses from said second list wherein said intervention being either by remotely reprogramming part or all of said
- 25    programmable wireless modules (10) or reconfiguring one or a plurality of said fixed or mobile assets (120) of one or a plurality of said subsets with new parameters and commands, and/or physically sending security officers and/or maintenance and/or medical personnel to the locations of said one or a plurality of
- 30    subsets of fixed or mobile assets (120) and/or to the location of said programmable wireless modules (10) for troubleshooting or doing the maintenance of said asset and/or programmable wireless modules (10) or physically handling said operating alarm as required, and/or
- 35    means for receiving and transmitting extended message service (EMS) and/or multimedia messaging service (MMS) message types, and/or

said program module further comprising means for encoding and decoding the Extended Mark-up Language (XML) and said local and/or remote system server service platform (150) further comprising a computer software interface in the form of object oriented fields or Java applets, and further receiving and transmitting XML or wireless binary XML (WBXML) coded data and SMS compressed messages, and/or

means for saving battery power for automatically putting said programmable wireless modules (10) in a sleeping mode when said programmable wireless module (10) does not need to transmit nor receive nor process data and further comprising auto-power up means to awake said programmable wireless modules (10) and put it back in an operating mode when a certain programmed date and/or time or preset alarm condition occur or when said fixed or mobile assets (120) or said local and/or remote system server service platform (150) are communicating to said programmable wireless module (10) to generate a radio (SMS) or network (E-mail) message, and/or

means for executing a power on self-test (POST), and means for uploading an acknowledgement status to said local or remote system server service platform (150).

6. A remote asset management system according to claim 5 wherein said programmable wireless module (10) further comprising;

means for controlling the duty cycle of said programmable wireless module (10) for periodically validating and invalidating during certain time of the day or week or month or year one or a plurality of said access code of a range of personnel in said first list to automatically control any public or personnel access to a protected area or precinct or building or floor wherein said public or personnel carrying an ID smart tag comprising said programmable wireless module (10) wherein said unique code being either its own wireless telephone number or a unique ID code or its PUK number,

means for remotely removing or replacing one or a plurality of said personnel and/or subscriber numbers in said personnel second list when said personnel is replaced or changes his telephone number and/or PC or IP address.

7. A remote asset management system according to claim 5 or 6 wherein said asset (120) further comprising;

5 a FLASH memory comprising an operating system to allow said asset (120) to operate in a plurality of modes, and  
a memory to store received commands and measured status data to be sent through said programmable wireless modules (10), and  
said asset (120) further comprising a blue tooth or an infra red or an ultrasonic or sound and/or a wired connection to said remote  
10 asset interface module (110) or being directly embedded with said programmable wireless modules (10) in a same housing to execute said wirelessly downloaded operational commands and or requests ,  
and  
one or a plurality of sensors and/or actuators and/or  
15 analogue/digital and digital/analogue converters to implement one of said applications of measuring physical data, wherein said actuators being either an electromechanical servo means or a stepper motor or a thermocouple or an inductive coil reading system, and  
20 means for sending on request or when being paged by said pager network or periodically or when configured emergency cases occur, functional status, alert conditions, alarm conditions and hardware anomaly information in real-time to said programmable wireless modules (10) to which said asset (120) is linked, and  
25 wherein said programmable wireless modules (10) in turn upload said functional status, alarm and hardware anomaly information to one or a plurality of telephone numbers and/or PC or IP addresses in the form of a message or of an E-mail, wherein said numbers and PC or IP addresses representing the different bodies involved in  
30 dealing with said alert or alarm conditions being either said remote and/or local system server service platforms (150) and/or said security officers and/or one of said subscribers and/or said medical teams and/or a specialised team as required by one of said applications.

35

8. A remote asset management system according to claim 7 wherein

said application is for monitoring mobile person or a group of people or for personnel location and surveillance or supervision in closed and open areas wherein

5 said closed areas being controlled compounds or airports or hospitals or buildings, or prisons or swimming pools or indoor sports resorts or leisure resorts or shopping centres and

said open areas being either outdoor sports resorts or leisure resorts or ski resorts or theme parks or beach resorts or national parks or protected areas being either military or civil, and  
10 wherein

said mobile personnel being personnel or crew or policemen officers or firemen or security officers or medical officers and

said supervised persons or group of people being children or elderly people or ill or disabled people or employees and wherein  
15 one or a plurality of said master programmable wireless modules (10) each being embedded in either a mobile telephone or a PDA comprising a micro hard disk being carried by a mobile team commanding personnel officers being either rescue or medical or security or authorised officers representing said intervening  
20 bodies, and each of said supervised person or group of people or personnel carrying each a slave programmable wireless module (10) embedded within a mobile phone or as a smart tag further comprising a unique button to take in and send a voice call allowing said people to be reassured in case they are lost or in  
25 danger and said smart tag further comprising said positioning module (40) (GPS) and means for automatically sending coordinates in text message via an SMS message or via GPRS, and

means for automatically paging each of a plurality of said slave programmable wireless modules (10) to respond with its unique ID  
30 code, and status data either including its precise location (GPS) or said remote managing system being able to calculate said coordinates within said closed or open area and/or medical status data when said programmable wireless modules (10) is carried by a medically supervised disabled person wherein said sensors are  
35 dedicated medical sensors controlling the health state of said disabled person and providing said wireless module (10) with medical status data, and

said local system server service platform being located within said open or closed area and further comprising means for checking said ID code against a local system server service platform authorised first list and a database stored in said hard disks of medical records and/or rights an obligations records of said supervised people regarding said application, further comprising means to determine whether said supervised person or personnel is in need of an intervention from medical or rescue or for said personnel to face an unforeseen situation or for a specific member of personnel to execute an order, and dynamically updating said remote assets (120) and sending all necessary information to be put in said first and second and third lists to allow different intervening teams each comprising a master and a plurality of slave programmable wireless modules (10) to synchronise their efforts to achieve their missions according to said application.

9. A remote asset management system according to claim 8 wherein said application is for monitoring unauthorised mobile persons or a group of people or for personnel location and surveillance or supervision in closed and open areas wherein said people or group of people carrying no programmable wireless module and/or said personnel entering said open or closed area illegally using said smart tag when not authorised, wherein

said local system server service platform comprising a database of known unauthorised personnel not on duty and a data base of undesired people or of people having a criminal record received by said local system service platform from the national police department,

means to send to authorised security officers located at predetermined checking points said status data to allow said local system server service platform to allow said authorised security officers to determine if an unauthorised personnel is illegally inside said area and said local system server service platform further transmitting a digital message to each of the security officers of the team in place in the vicinity of said unauthorised personnel with his photograph and personal data and its location within said area by means of one or a plurality of MMS and/or SMS messages in order for said security officers to

locate said unauthorised personnel visually and take the necessary action, and

5       said local system server service platform comprising means for controlling in real time a plurality of said smart tags for further allowing said local system server administrator to manage the presence, time, and the exact location of each of said supervised person or personnel within said area in real-time, and

10       said local system server service platform comprising means for receiving from the police representative a list and status data of criminal records of people to be either prohibited to penetrate said compound or to be more carefully checked or supervised or arrested by police personnel carrying said programmable wireless module (10) embedded in either a cellular telephone or a PDA comprising a micro hard disk, to which an SMS and/or MMS message  
15       should be sent to let them know the person's appearance and where said person is to be encountered within said area,

      said smart tags carried by personnel further comprising a LCD screen to which messages can be read and allowing said local system server service platform to further send messages to said  
20       area security officer and to said personnel to assess their status authorised or not authorised, and/or

      said local system server service platform being further linked to a remote system server service platform (150) to synchronise their authorised personnel database and suspicious people  
25       database and share said databases with different local system server service platforms located at different supervised open or closed areas nation wide and/or world wide.

10.    A remote asset management system according to claim 7 wherein  
30       said application is for managing a network of vending machines wherein

      said actuators lock said vending machine when specific conditions are met wherein said specific conditions being for prohibiting access to said vending machine when not desired, and

35       said sensors gather measured data wherein said measured data being the number of times the door is open and/or how many of each good has being bought in a programmable period of time and/or the amount of cash there is in said machine, and

said sensors further gathering said machine diagnostic status and/or failure and/ or temperature variation and/or unauthorised movement or of goods being taken , wherein

5 said measured data are each sent by said programmable wireless module (10) to the corresponding service personnel for an appropriate operation located at said local fixed or mobile in a vehicle en route or remote system server service platform (150), said operation being launched after collecting and analysing said measured data, wherein

10 said operation being remote warranty diagnostic, and route planning allowing retailers to take the optimum route for carrying the exact quantity of each product in order to refill said network of vending machines, and stock planning and cash monitoring allowing said local or remote system server service platform (150)  
15 to optimise the product mix available for each of said vending machine, and also knowing the exact cash amount to be collected for each of said vending machine, and

said operation further being service and part requirements, for allowing said vending machine maintenance service to send local  
20 engineers of the service and part requirements knowing the exact parts to be repaired or replaced, and

said vending machine further comprising one of said sensors to detect unauthorised movement of said vending machine to send an alarm to the security service for a quick intervention.

25

11. A remote asset management system according to claim 7 wherein said application is for utility metering of private or public precincts wherein

said utility metering being water and/or gas and/or electric  
30 and/or flow and/or fluid level metering wherein each of said programmable wireless modules (10) is linked to one or a plurality of same utilities wherein each of said programmable wireless module (10) passes status data on request or when paged by said pager network or periodically in the form of an SMS message or via  
35 GPRS to the respective utility company each associated with a local or remote system server service platform (150), for billing and statistic and maintenance purposes, and

said data in the XML or WBXML and/or in said application adapted format to allow respective utility companies to send said information to their clients either by Internet or by mail.

- 5 12. A remote asset management system according to claim 7 wherein  
said application is for vehicle telematics wherein independent  
vehicles subscribing individually to a service from a vehicle  
telematics and security service provider or as a fleet of vehicles  
wherein said vehicles being taxis or corporate cars, or busses or  
10 trains or aircraft or boats or bicycles wherein  
each of said vehicles being further equipped with said  
programmable wireless module (10) and said mobile asset (110)  
comprising an onboard computer comprising a screen,  
said telematics application being remote diagnostics and/or live  
15 navigation assistance and/or weather conditions and/or information  
of interest services and/or real time traffic information and  
alternative route advises to avoid traffic congestion and/or voice  
recorder and/or vehicle tracking and/or storing received telephone  
numbers calling and/or E-mail messages, wherein  
20 said information and status data are displayed in the proper  
format wherein said location information are embedded in a  
digital map and others information are as well displayed to give  
the driver or pilot a clear view of the actual situation and  
whereabouts, and/or  
25 said vehicle further comprising an anti theft system embedded in  
the electronic component of the motor of said vehicle controlling  
the motor ignition and door opening and automatically sending an  
SMS to said local and/or remote system server service platform  
(150) and/or to the police and/or security department where said  
30 vehicle is to report said theft and the precise coordinates using  
said GSM module or said locating module of said vehicle, and  
said programmable wireless module (10) periodically sending or  
on request or when paged by said pager network useful diagnostic  
data to the remote maintenance computer located in said local or  
35 remote system server service platform (150) in charge of said  
vehicle to allow parts ordering for replacement before breaking  
and said computer remotely updating operating parameters of said  
vehicle and automatically requesting a maintenance appointment and



giving the address and path to the specialised garage in the case of a terrestrial vehicle or signalling to the maintenance team to take charge of said vehicle and exactly knowing what repair or maintenance to do when out of the normal maintenance schedule,  
5 and/or

said remote maintenance computer adapting the functioning parameters according to said received diagnostic statuses in order to allow an optimum modified vehicle operating capability for reasons of performance and security.

10

13. A remote asset management system according to claim 7 wherein said application is for use in a facility management system wherein

said facility being hospitals or pharmaceutical or biological or  
15 medical research laboratories and/or clean rooms of semiconductors manufacturers or building automation systems of private or public building or home automation, wherein

said assets being facility appliances for burglar alarms and/or goods refrigeration devices and/or room temperature regulation  
20 devices and/or for electronic key control and/or automatic door opening devices and/or panic hardware devices and/or fire and/or smoke detection devices and/or false alarm protection devices and/or for a filtering system for air intake systems and/or a security camera or video camera and/or elevators and/or fan system  
25 control devices and/or heating system and/or solid-state video recorder and/or sauna heater, wherein

said sensors being for air velocity and flow and/or temperature and/or air pollution and/or humidity and/or CO2 and/or combustible gas and/or gas flame measurement and/or movement or pressure for  
30 intruder detection and/or utility metering,

each of said appliances being further linked to one of said programmable wireless modules (10) either in the same housing or via a blue tooth radio link or via direct connection through said remote asset interface module (110) for reporting respectively  
35 measured data to respective local and/or remote system server service platform (150) wherein said local or remote system server service platform (150) being located in said facility perimeter and comprising a computer for responding adequately to one of said

alert and/or alarm by sending status data to the required services and by passing updated parameters either pre-programmed or received from said required services to allow said facility to operate safely, wherein said facility management system further comprising

means for remotely controlling said facility management system by a supervisor and/or one of said subscribers wherein said means being a PDA comprising a micro hard disk or a Laptop computer, embedded with one of said programmable wireless modules (10) wherein said controlling means comprising means for receiving status data and/or a photograph of an intruder in the form of one or more MMS messages.

14. A remote asset management system according to claim 7 wherein said application is for environmental sensing system or for supervising local and/or global environmental conditions wherein

said environmental conditions are weather control and forecast or greenhouse effect measurement or earthquake warning/prediction or volcano supervision or sea temperature and sea current supervision and wave height and displacement speed and oil spillage propagation or atmosphere supervision or tornado formation or river contamination and flood prediction, wherein

said programmable wireless module (10) being mounted with said sensors in a carrier adapted to the environment, and

said sensors being air and/or sea pressure sensors and/or tectonic sensors and/or temperature sensors and/or air speed sensors and/or water flow sensors and/or specific chemical substance sensors and/or high atmosphere probes and

said measured data being acidity level and/or alkalinity level and/or concentration of dissolved oxygen and/or carbon monoxide level and/or contaminant concentration and/or level of radioactivity and/or ultrasound level and/or carbon dioxide concentration or atmospheric temperature or surface sea water and/or deep sea water temperature and/or air pressure and/or humidity level and/or pollution or contamination level and/or levels of rivers and/or wind speed, and

said remote system server service platform (150) collecting said data for allowing short term and long term weather forecast and

storm and other dramatic weather situations or tsunami or earthquake early warning and/or pollution or contamination level assessment of supervised sea and atmosphere and supervised river and lake and earth zone.

5

15. A remote asset management system according to claim 7 wherein said application is for freight or object-tracking and/or marshalling yard of said freight or object in supervised areas wherein

10 said freight or objects containers comprising a programmable wireless module (10) embedded in a housing with said positioning module (40) being either a GPS module or a beacon system or a pageable module to be able to locate said programmable wireless module (10) wherein

15 said areas being airport or bus station or train station or sea or lake or river port or railway network or road network or open sea and

each of said objects, being luggage or packages or parcels and said containers all located in boat or aircraft or train or truck  
20 or bus or packet delivery vans or vehicles, wherein each of said object comprising a smart tag, wherein

said smart tag being further capable of sending status data of said freight or objects in a wagon and/or in a container and/or in a trailer when said wagon and/or in a container and/or in a  
25 trailer comprising more than one tagged object, either through said wagon and/or in a container and/or trailer programmable wireless module (10) by means of a short distance radio transmitter or blue tooth, or directly by means of an embedded personal programmable wireless module (10) when said freight or  
30 object deserves a special care.

16. A method for managing a remote asset management system comprising a fixed remote operator centre comprising a remote system server service platform (150), said remote asset management system further comprising a network of programmable wireless modules (10) communicating via a standard radio communication protocol, each of said programmable wireless modules (10) being linked to one or a plurality of fixed or mobile assets (120) to be remotely managed wherein programs, commands, parameters, and status data pass through said network of programmable wireless modules (10), each of said programmable wireless modules (10) further comprising an identification module, a telecommunications chipset (20) comprising an antenna (30) to communicate via a mobile telecommunications infrastructure (400) said telecommunication chipset (20) further comprising means for communicating via a standard wireless telecommunication network being either GSM (global system for mobile telecommunication) or GPRS (general packet radio service) or CDMA (Code division multiple access) or WCDMA (wide band CDMA) or CDMA2000 or WLAN (wireless LAN) or PDC (Personal Digital Cellular), or a pager network or via a satellite telecommunications system, said programmable wireless modules (10) may further comprise means (100) indicating the current mode of operation of said programmable wireless module (10), a data processing means (60) comprising a micro-controller and a software module, a FLASH memory and a memory module (70) and further comprising a power supply being supplied externally or via a battery (80), said method of managing said remote asset management system being characterised by the steps of:

remotely programming by a remote system server service administrator said network of programmable wireless modules (10) at said remote system server service platform (150) via said standard radio communication protocol and/or via a LAN, with one or a plurality of same or different remote assets management applications or personal security applications, causing said programmable wireless modules (10) to pass the data to and from one or a plurality of said linked fixed or mobile

assets (120) for configuring, testing, monitoring and controlling said network of fixed or mobile assets (120), and

servicing by said remote system server service administrator a plurality of subscribers by remotely managing a different set or subsets of fixed or mobile assets (120) on behalf of each of said plurality of subscribers, said remote system server service platform (150) being further linked to one or a plurality of fixed and/or mobile local system server service platform,

servicing by a local system server service administrator at said local system server service platform part of said plurality of subscribers for remotely managing one or a plurality of said subsets of fixed or mobile assets (120) on behalf of said remote system server service platform (150) further comprising one of said programmable wireless module (10) and a computer integrating operating, planning and management functions modules,

each of said one or a plurality of local system server service platforms further communicating to said remote system server service platform (150) via said standard radio communication protocol and/or via a LAN or a web page or by E-mail.

20

17. A method for managing a remote asset management system according to claim 16 wherein each of said one or a plurality of local system server service platforms being a master for managing one or a plurality of slave programmable wireless modules (10) forming one of said subsets of fixed or mobile assets (120) each dedicated to the same global task of remotely monitoring one or a plurality of said same or different assets (120) according to one of said applications wherein said subsets of fixed or mobile assets (120) sharing measured data in order to synchronise their actions to globally achieve said application.

30

18. A method for managing a remote asset management system according to claim 17 wherein said step of remotely programming said network of programmable wireless modules (10) further comprising the steps of;

remotely initiating by said local or remote system server service administrator said respective set or subsets of said programmable wireless modules (10) by sending to said identification module of each of said programmable wireless modules (10) a unique encrypted code (PUK), and testing said respective set or subsets of said programmable wireless modules (10) and responding to said local or remote system server service administrator by an acknowledgement signal, and further putting each of said programmable wireless modules (10) in a programming mode,

broadcasting a first list of one or a plurality of hierarchical privileged access codes to each set or subsets of said programmable wireless modules (10), said access codes being either mobile or fixed telephone numbers and/or PC or IP addresses, of different authorised personnel and/or subscribers to remotely access said set or subsets of said programmable wireless modules (10) and their linked one or a plurality of same or different fixed or mobile assets (120), and

broadcasting a second list of one or a plurality of telephone numbers and/or PC or IP addresses of same or different authorised personnel and/or subscribers for said programmable wireless module (10) to be called either on request and/or when paged by said pager network and/or periodically according to a programmed period and/or in case of emergency for transmitting formatted status and alarm reports according to said remote assets management application requirements, and further putting each of said programmable wireless modules (10) in an asset initiating mode, and

broadcasting a third list of the data type and capabilities of same or different one or a plurality of fixed or mobile assets (120) wherein said data types being asset type and/or model number and/or OS type and/or power supply and/or battery supply and/or duty cycle parameters of wake up versus sleep mode duration and/or

enabled or disabled asset functionality and/or location data and/or service history and/or location history and/or performance optimisation and/or security lock-down features and of said commands and said parameters information wherein said parameters information being about corresponding services, maintenance, operating modes and emergency procedures, and

testing each of said fixed or mobile assets (120) each responding by an acknowledgement signal to said programmable wireless modules (10) to which each of said fixed or mobile assets (120) is linked which report it to said local or remote system server service administrator, wherein said received and transmitted encrypted digital data are in the form of a data call or by GPRS or of one or concatenated short messages of the SMS sort or E-mails, and further

putting each of said programmable wireless modules (10) in one of a plurality of operating modes, wherein

In-between active operating modes said programmable wireless modules puts itself in a sleeping mode and awakes by a predetermined request from an administrator or periodically according to a programmed period or by a predetermined condition or alert or alarm condition from one of said fixed or mobile assets (120).

19. A method for managing a remote asset management system according to claim 18 wherein said step of programming each of said set or subsets of fixed or mobile assets (120) further comprising the steps of;

said fixed or mobile local or remote system server service platform (150) sending encrypted digital data in the form of a data call or via GPRS or in the form of one or a plurality of concatenated short messages of the SMS sort or E-mails to said respective set or subsets of programmable wireless modules (10),

receiving by said programmable wireless module (10) said encrypted digital data comprising commands and requests for said fixed or mobile assets (120) and an encrypted security code,

authenticating said received encrypted security code against authorised personnel or subscriber codes from said stored first list for granting access and/or control of all or a selected

number of authorised asset appliances according to said privilege level, and

5 downloading said commands and corresponding parameters from said third list and said request to one or a plurality of said fixed or mobile assets (120) to which each of said programmable wireless modules (10) is wirelessly linked and/or wired, wherein said commands indicate a period to automatically transmit data and the actual fixed or mobile assets (120) configuration and the actual operating mode in order to implement said management application  
10 or personal security application requirements, and further putting each of said one or a plurality of fixed or mobile assets (120) in one of a plurality of operating modes, and further providing each service being technical or administrative or security or medical or to the subscribers with the unique status  
15 data they need and for archiving and processing said status data automatically in real time at one of said local or remote system server service platform (150).

20. A method for managing a remote asset management system according to claim 19 comprising the steps of;  
20 periodically or when requested by a local or remote network administrator, polling said respective set or subsets of fixed or mobile assets (120) by said programmable wireless module (10) to which one or a plurality of said fixed or mobile assets (120) are  
25 attached for sending said status data and/or alarm condition history according to a request from said fixed or mobile local or remote system server service platform (150) wherein said status data information are formatted in XML to be directly workable into a dedicated spreadsheet documents and/or web pages (GPRS) for  
30 either technical diagnosis and/or maintenance planning and/or billing and/or balance sheet and/or schedule of assets and/or ordering goods and  
said fixed or mobile assets (120) further sending to said programmable wireless module (10) to which they are linked either  
35 by means of a blue tooth or an infra red or an ultrasonic or sound or a wired connection, hardware status data through an analogue and/or a digital port (92) further connecting said programmable wireless module (10) to a remote asset interface module (110)



communicating with one or a plurality of said fixed or mobile assets (120), via a wired or wireless connection for maintenance purposes, operational status data for administrative purpose, and alarms indicating an out of range condition in said actual  
5 operating mode,

automatically receiving by said programmable wireless module (10) said fixed or mobile assets (120), said requested or said periodically sent status data and/or alarm condition from said fixed or mobile assets (120) according to said command indicating  
10 the period for sending data or according to a command to define said alarm condition,

said programmable wireless module (10) further encrypting said digital data for appropriately sending said data via said standard radio communication protocol and/or via a LAN either via a web  
15 page or E-mail,

storing in a storage device and/or transmitting said encrypted digital data in the form of a data call or via GPRS or in the form of one or a plurality of concatenated short messages of the SMS sort or E-mail or web page (GPRS) to prioritised numbers and/or PC  
20 or IP addresses stored in said second list, to report formatted functional status data in real time either to said fixed and/or mobile local system server service platform for maintenance purposes and online following up of a controlled process, or to said remote system server service platform (150) for technical  
25 supervision and management purposes, and

reporting said alarm with priority when said alarm occurs or any fixed or mobile asset (120) hardware anomaly information requiring an intervention in real time to one or more numbers and/or PC or IP addresses from said second list and/or to said fixed or mobile  
30 local or remote system server service platform (150) in order to allow respective maintenance officer and/or security officer and/or administrator and/or subscribers to intervene appropriately.

35 21. A method for managing a remote asset management system according to claim 20 comprising the steps of;

positioning said programmable wireless modules (10) further comprising means for positioning (40) and an antenna (50) for

tracking the location of said associated mobile assets (120) located in a mobile object wherein said application consisting in real time fleet supervision and management, wherein said mobile objects being busses or trucks or taxis or ambulances or trains or aircraft's or police vehicles,

reporting said location of said mobile object to a system server service platform (150) administrator wherein said location is indicated on a map on his computer screen and further stored in a hard disk for further treatment, and/or

reporting said location of said mobile object to an onboard computer wherein a programmable wireless module (10) is embedded, located in said mobile object for guidance purposes wherein said message being in the form of a MMS integrating said location on a map in the screen of said onboard computer.

22. A method for managing a remote asset management system according to claim 20 or 21 comprising the steps of;

establishing a voice connection by an authorised caller with said programmable wireless module (10) embedded in one of said mobile asset (120), receiving voice messages comprising a voice command and a voice code and recognising said voice commands and said voice code by means of a voice recognition software wherein said voice recognition software carrying out a voice recognition conversion either at said local or remote system server service platform (150) or at said mobile asset (120),

authenticating said received encrypted security code within said voice message against authorised codes from said stored first list for granting access and/or control of authorised asset appliances according to said privilege level, wherein said asset appliances are cellular telephone or PDA or rugged clothes tag or a medical appliance,

executing said voice command associated task comprising reading status and/or transmitting new operating data mode to said appliance,

reporting back status data to in the form of data call or of one or concatenated short messages of the SMS sort or E-mail or web page to prioritised numbers and/or PC or IP addresses stored in said second list upon the bearer being either health data or/and

location wherein said status data being supervision and/or  
diagnostic data and/or

allowing the bearer of said mobile asset (120) to vocally  
communicate with said caller for disabled or old people

5 surveillance or sport persons surveillance in remote places or  
personnel surveillance purposes either said caller being part of a  
medical surveillance team or of a security surveillance team or of  
a rescue team and/or allowing only a two way voice data flow.

10

23. A remote asset management system comprising a fixed remote operator centre comprising a remote system server service platform (150), said remote asset management system further comprising a network of programmable wireless modules (10) communicating via a radio communication network, each of said programmable wireless modules (10) being linked to at least one asset (120) to be remotely managed wherein programs, commands, parameters, and status data pass through said network of programmable wireless modules (10), each of said programmable wireless modules (10) further comprising an identification module, a telecommunications chipset (20) comprising an antenna (30) to communicate via a mobile telecommunications infrastructure (400) said telecommunication chipset (20) further comprising means for communicating via a wireless telecommunication network, said programmable wireless modules (10) further comprises means (100) indicating the current mode of operation of said programmable wireless module (10), a data processing means (60) comprising a micro-controller and a software module, a FLASH memory and a memory module (70) and further comprising a power supply being supplied externally or via a battery (80), said remote asset management system being characterised in that:

said remote system server service platform (150) comprises a dedicated software for remotely programming said network of programmable wireless modules (10) via said radio communication network, with at least one remote asset management applications or personal security applications and for causing said programmable wireless modules (10) to pass data between at least one linked asset (120) for remotely configuring, testing, monitoring and controlling one or more linked fixed or mobile assets within said network of fixed or mobile assets (120), and

said remote system server service platform (150) further comprising means for servicing a plurality of subscribers for remotely managing a different set of assets (120) on behalf of each of said plurality of subscribers, and

said remote system server service platform (150) being further linked to at least one local system server service platforms

comprising means for servicing part of said plurality of subscribers for remotely managing at least one of said sets of assets (120) on behalf of said remote system server service platform (150) further comprising the functionality of one of said programmable wireless modules (10) and a computer integrating the set of operating, planning and management functions modules.

24. A method for managing a remote asset management system comprising a fixed remote operator centre comprising a remote system server service platform (150), said remote asset management system further comprising a network of programmable wireless modules (10) communicating via a radio communication network, each of said programmable wireless modules (10) being linked to at least one assets (120) to be remotely managed wherein programs, commands, parameters, and status data pass through said network of programmable wireless modules (10), each of said programmable wireless modules (10) further comprising an identification module, a telecommunications chipset (20) comprising an antenna (30) to communicate via a mobile telecommunications infrastructure (400) said telecommunication chipset (20) further comprising means for communicating via a wireless telecommunication network, said programmable wireless modules (10) may further comprise means (100) indicating the current mode of operation of said programmable wireless module (10), a data processing means (60) comprising a micro-controller and a software module, a FLASH memory and a memory module (70) and further comprising a power supply being supplied externally or via a battery (80), said method of managing said remote asset management system being characterised by the steps of:

remotely programming by a remote system server service administrator said network of programmable wireless modules (10) at said remote system server service platform (150) via said radio communication network, with at least one remote asset management applications or personal security applications,

causing said programmable wireless modules (10) to pass the data between at least one of said linked assets (120) for configuring,

testing, monitoring and controlling said network of assets (120),  
and

servicing by said remote system server service administrator a  
plurality of subscribers by remotely managing a different set of  
5 assets (120) on behalf of each of said plurality of subscribers,  
said remote system server service platform (150) being further  
linked to at least one of local system server service platform,  
servicing by a local system server service administrator at said  
local system server service platform part of said plurality of  
10 subscribers for remotely managing at least one of said sets of  
assets (120) on behalf of said remote system server service  
platform (150) further comprising one of said programmable  
wireless module (10) and a computer integrating operating,  
planning and management functions modules,  
15 each of said at least one local system server service platforms  
further communicating to said remote system server service  
platform (150) via said radio communication network.

FIG. 1

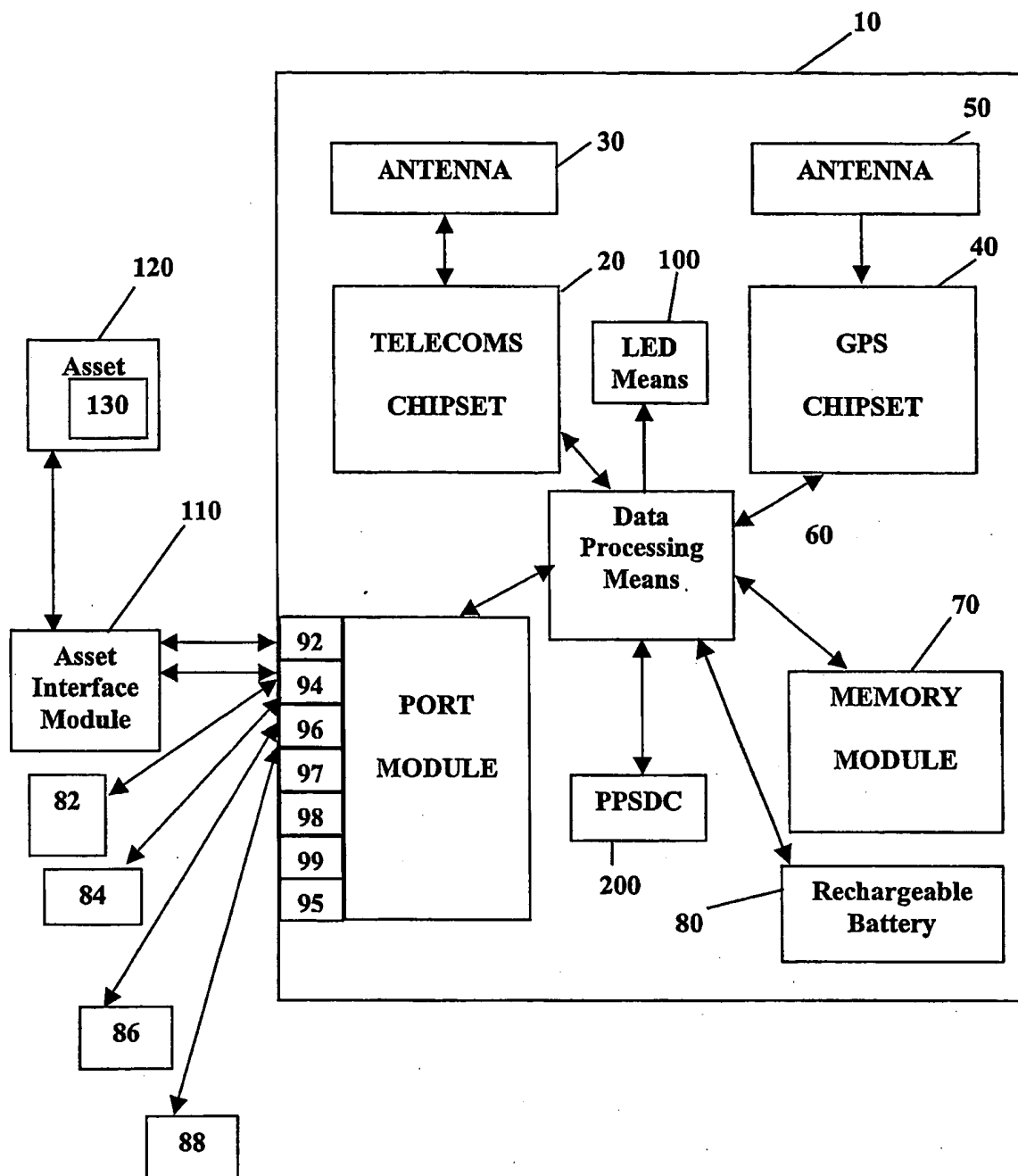


FIG. 2

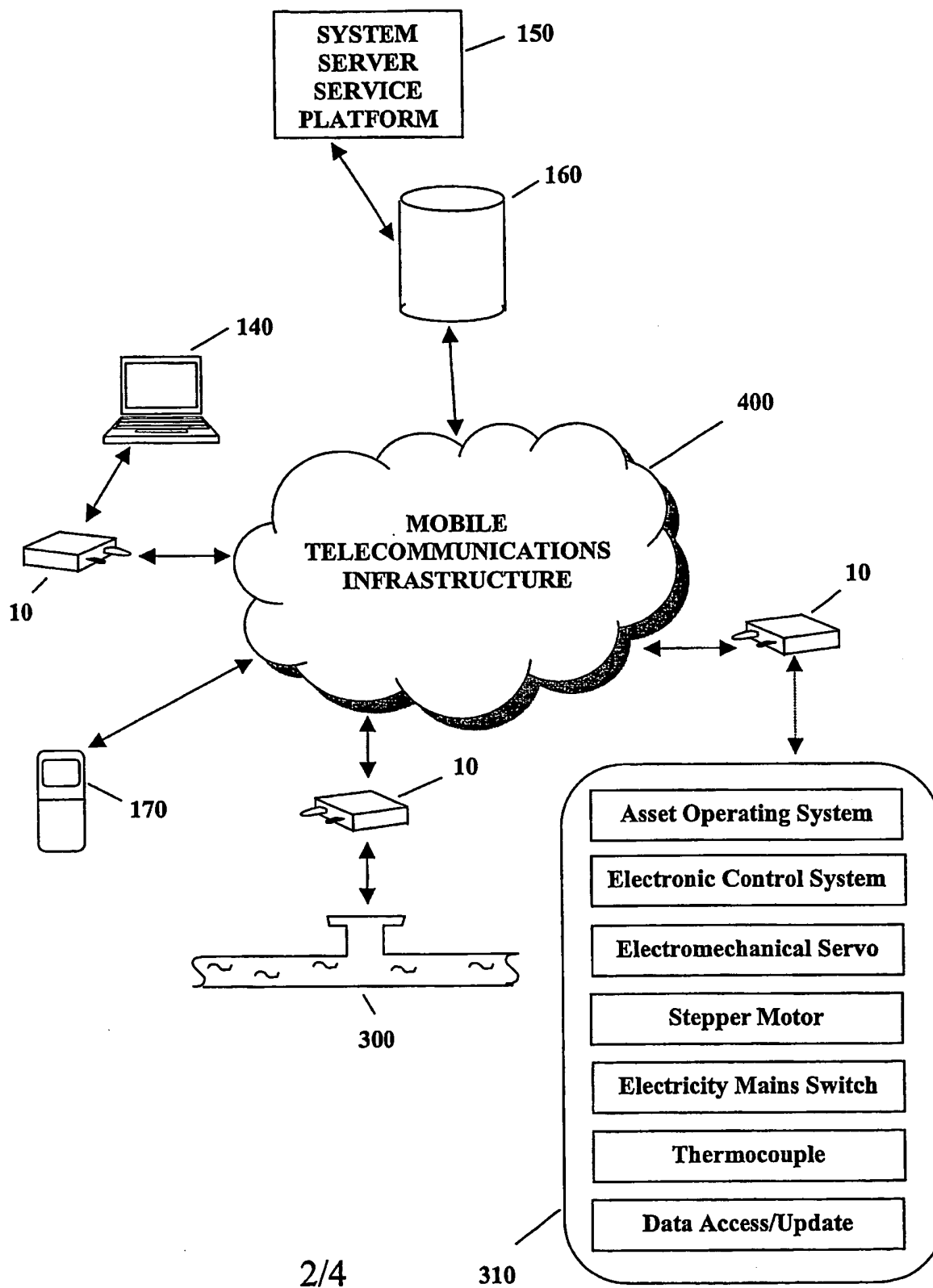
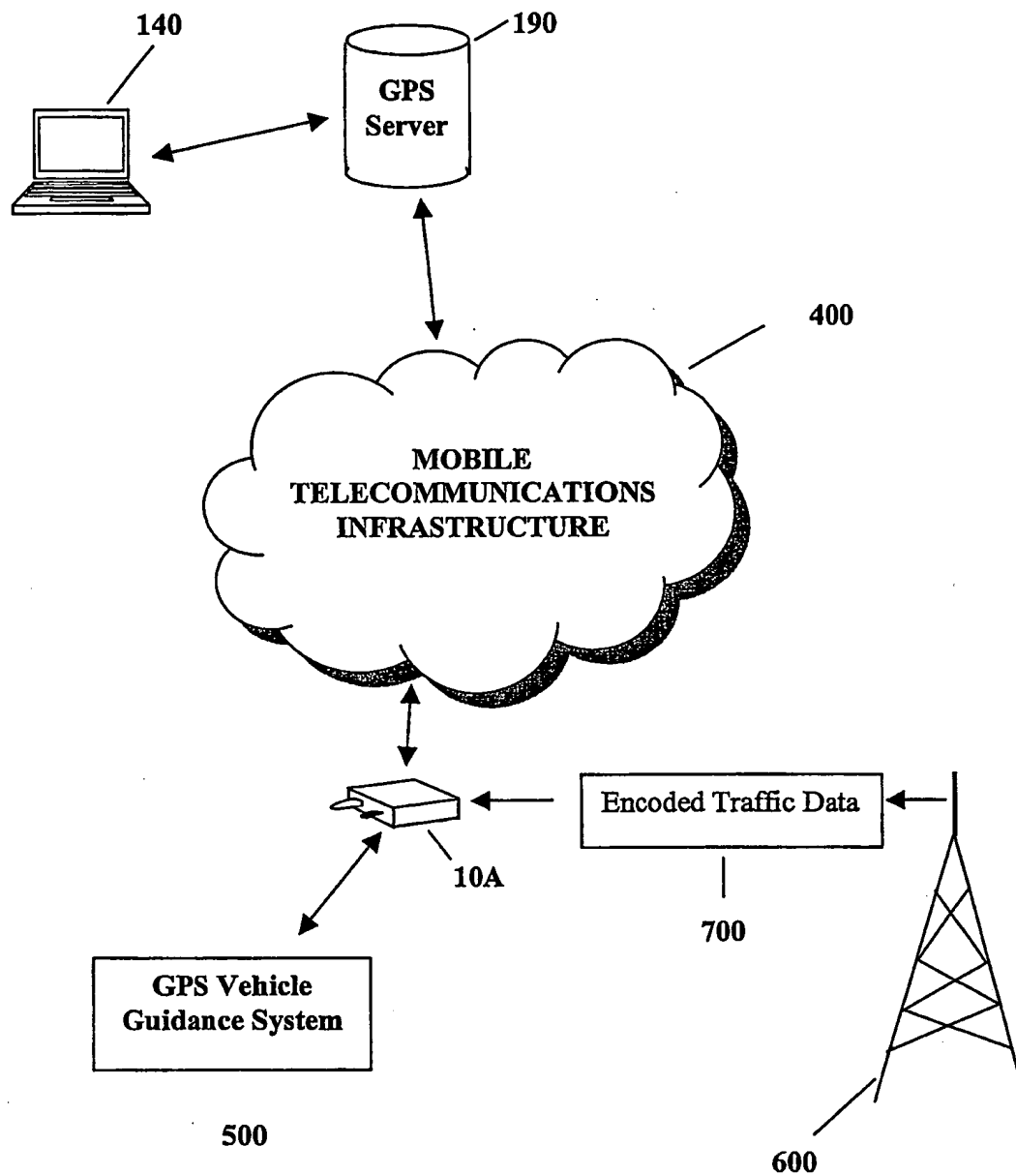
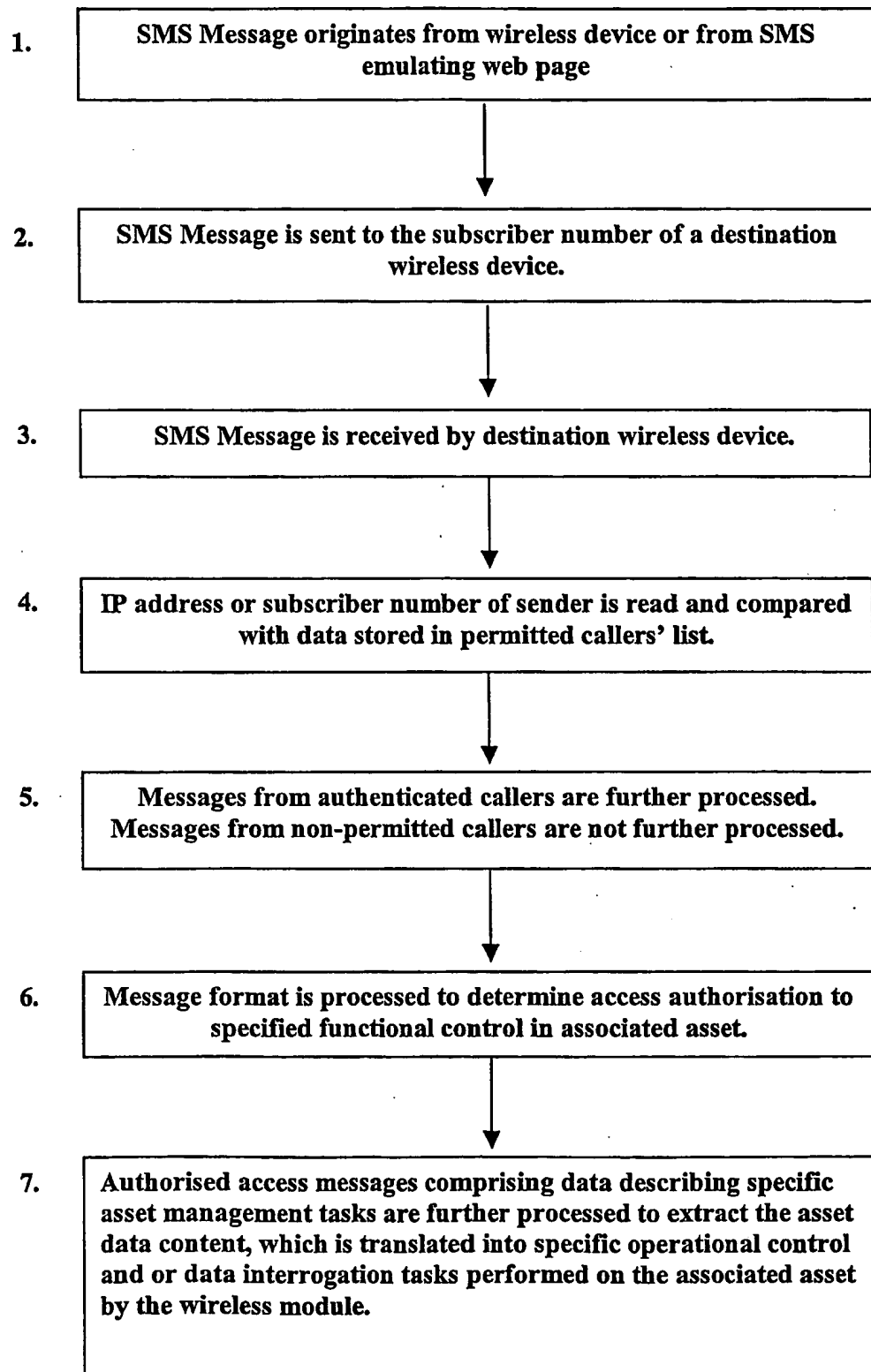




FIG. 3



**FIG. 4**

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 03/02171

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H04M11/00 H04M11/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04M H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 70889 A (MEDTRONIC PHYSIO CONTROL MFG C) 23 November 2000 (2000-11-23) abstract figures 1,2,4,7 page 1, line 4 -page 3, line 30 page 4, line 32 -page 5; claim 15 page 6, line 24 -page 8, line 31 page 11, line 30 -page 12, line 14	1-24
A	WO 00 56016 A (ALBRECHT THOMAS ;SIEMENS AG OESTERREICH (AT)) 21 September 2000 (2000-09-21) abstract figure 1 page 1, paragraph 1 - paragraph 3 page 2, paragraph 6 -page 3, paragraph 2 page 3, paragraph 6 -page 8, paragraph 4 -/-	1-24

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

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Date of the actual completion of the international search

17 October 2003

Date of mailing of the international search report

28/10/2003

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## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 03/02171

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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